CHAPTER 7

HOW TO WRITE A SCIENTIFIC PAPER

7.1 OVERVIEW

Writing is inherently a creative process.

You do not have to be a good writer to write a good scientific paper. The reason is this: there is a **formula** for how to structure and organize a scientific paper, so that the scientist/writer can focus on what they know best—the science—and worry less about the writing.

But for the scientific paper, the emphasis must always stay on the science, with the words mere tools for effectively conveying information.

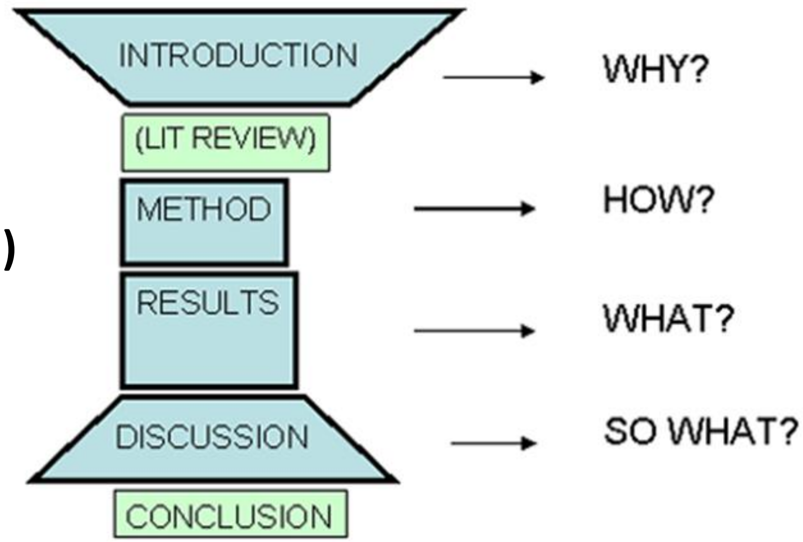
A major difference between journal-based science writing and the diverse forms of writing found elsewhere is the very limited scope of our medium. A scientific paper does not have to be all things to all people. It is a narrow genre with a narrow (though very important) purpose. A specific scientific community is not a random sampling of humanity but a group that shares an established and understood basic scientific background, a broadly agreed-upon set of common goals, and an already established set of mechanisms for the communication of information.

By following the standard structure and organization of a science research article, the author is constrained in many respects. But these constraints free the author and the reader to focus on the content, which often results in a better paper.

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

The vast majority of papers published in scientific journals today follow a fairly simple structure. With some variations, most papers use an "**IMRaD**" format

- **Introduction**
- **Method (experiment, theory, design, model)**
- **Results and Discussion**
- **Conclusions**



There are two main advantages of following the **IMRaD** structure: :

1. it makes it easier for the writer to organize the content of the paper
2. it makes it easier for the reader to opportunistically find the information they seek.

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.1 Introduction

In standard rhetoric, the Introduction section should answer two questions::

1. what is the paper about?

2. why should the reader care?

Thus, an introduction should inform the reader as to what the paper is about and motivate the reader to continue reading.

What should an introduction contain?

The basic flow of the introduction starts with the general and then moves to the specific.

The research-article introduction moves through three phases:

1. Establish a territory (what is the field of the work, why is this field important, what has already been done?)
2. Establish a niche (indicate a gap, raise a question, or challenge prior work in this territory).
3. Occupy that niche (outline the purpose and announce the present research).

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.1 Introduction

Some common pitfalls in writing an introduction:

- providing unnecessary background information (telling the reader what they already know or what they do not need to know)
- exaggerating the importance of the work
- failing to make clear what research questions this paper is trying to answer.

Let's try to analyze this structure in an article published on Applied Physics Letters journal

APPLIED PHYSICS LETTERS **103**, 021105 (2013)

CrossMark

Terahertz quartz enhanced photo-acoustic sensor

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7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.1 Introduction

Recent technological innovation in photonics and nanotechnology is now enabling Terahertz (THz) research to be applied in an increasingly wide variety of applications, such as information and communications technology, medical sciences, global environmental monitoring, homeland security, quality and process controls. Most of the above applications involve the use of THz spectroscopic systems. Explosives, narcotics, and toxic gases (i.e., carbon monoxide, hydrogen cyanide, hydrogen chloride and methanol) have indeed distinct spectral "fingerprints" and strong absorption bands across the THz range.

Territory: Applications requiring THz sources

To address the above application requirements, suitable sensing systems equipped with high power, widely tunable sources, and high speed, high sensitivity detectors have to be developed. To date, only a few systems have been successfully demonstrated to operate across the far-infrared. Photomixing-based sensors in the 0.5–1.5 THz range have been recently proposed[1] for detection of HCN, CO, H_2CO, reaching sensitivities of 9 parts per million in volume (ppm), 0.1% and 114 ppm, respectively. Broadband OCS, N_2O, and CH_3OH sensors at 0.5 THz, based on chirped-pulse THz absorption spectroscopy, have been also demonstrated, reaching noise equivalent concentration of a few hundreds ppm.[2] Methyl chloride detection in the ppm range with long-baseline THz spectroscopy based on a White cell design has been also reported.[3]

what has already been done

HOW TO WRITE A SCIENTIFIC PAPER

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.1 Introduction

The described systems suffer from the low power levels of the employed THz sources and/or the low sensitivity of the detection units. THz quantum cascade lasers (QCLs) can offer a significant improvement in terms of compactness and sensitivity levels, stemming from the single-mode high spectral purity emission,[4] the relatively broad tunability range (up to 10% of the central frequency),[5] the high continuous wave (CW) output power levels (up to 138 mW),[6] and the relatively good compactness provided by Stirling cryocooler systems. THz QCLs have indeed recently demonstrated interesting performance in high resolution molecular spectroscopies, in both direct absorption[7–10] or wavelength modulation spectroscopy,[11] showing a minimum detectable absorption α_{min} in the $10^{-6}\,cm^{-1}Hz^{-1/2}$ range, mostly thanks to the employed sensitive cryogenic detectors. Improving such detection sensitivities requires either switching to novel low noise equivalent power (NEP) room temperature nanodetectors,[12,13] or moving to alternative high performance spectroscopic techniques.

The gap

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.1 Introduzione

Quartz-enhanced photo-acoustic spectroscopy (QEPAS) showed high sensitivity, fast time-response and high compactness in the near-IR and mid-IR spectral ranges. The distinguishing feature of QEPAS is the use of a low loss quartz tuning fork (QTF) for detection of the optically generated sound.[14] Very efficient mid-IR QCL-based QEPAS sensors have been recently demonstrated for trace detection of several chemical gas species,[14–17] with a record normalized noise-equivalent absorption (NNEA) sensitivity of 2.7×10^{-10} W·cm^{-1}·Hz$^{-1/2}$ (1σ) for SF_6,[18] corresponding to an α_{min} of 1.5×10^{-8} cm^{-1}Hz$^{-1/2}$ and a detection limit of 50 parts per trillion (ppt) in 1 s. One of the main advantages of the photoacoustic spectroscopy techniques is that no optical detection is required.[19] Thus, the extension of the QEPAS technique in the THz range would allow to avoid the use of low-noise but expensive, bulky, and cryogenic bolometers.

The Exploration field

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.1 Introduction

Standard QTFs have resonance frequencies of ~32.7 kHz and are characterized by a very small sensitive volume between its prongs (~$0.3 \times 0.3 \times 3\ mm^3$). In QEPAS experiments, it is critical to avoid laser illumination of the QTF, since the radiation blocked by the QTF prongs results in an undesirable non-zero background. This background can be several times larger than the thermal noise level of QEPAS and carries a shifting fringe-like interference pattern, which strongly limit the sensor detection sensitivity.[18,20] The reduced space (300 μm) between the QTF prongs, comparable with the wavelength of THz sources, so far has represented the main limitation preventing the use of QEPAS system in THz range. Larger size QTFs are, therefore, mandatory to operate in the THz range.

→ **The Challenge**

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.1 Introduction

In this paper, we report on the development of a THz QEPAS sensor employing a 3.93 THz QCL and custom-made QTF. Standard photolithographic techniques were used to etch the custom QTF, starting from z-cut quartz wafer. Chromium/gold contacts were deposited on both sides of the QTF. The overall QTF dimension was 3.3 cm × 0.4 cm × 0.8 cm; each prong was 2.0 cm long and 2.5 mm wide. The gap between the prongs was ~1 mm. The QTF first flexion resonance falls at $f_0 \sim 4246$ Hz, in agreement with previous studies reported for a similar QTF.[21] At atmospheric pressure we measured a Q factor of 9930. For our QEPAS THz sensor demonstration we selected methanol as target gas molecule. Methanol is widely used as a solvent, detergent, or even denaturant additive for industrial ethanol, and its ingestion can be fatal due to its toxication.

Announce the present research

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.2 METHOD

This section describes **how the results were generated**.

- It should be sufficiently detailed so that an independent researcher working in the same field could reproduce the results sufficiently to allow validation of the conclusions.
- For some research articles, it is the method that is novel. For this case, a much more detailed description is required. For standard or well-established methods, naming the method may be sufficient.

There are really two interrelated goals at work:

1. ability to reproduce the results
2. the ability to judge the results.

Although very few readers attempt a replication of another's experiment, most careful readers attempt to judge the validity of the work they are reading.

Without a carefullywritten method section, it becomes impossible to assess the validity of the work.

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.2 METHOD

The method can include:

- The development of a **novel theory**
- The establishment of a **specific device design**
- The description of **setup** used to get the data that will be shown.

A good method section :

- should not only describe what was done and how it was done, but it should justify the experimental design as well. Of the many options available, why was this method chosen?
- Should include statistical considerations, such as sampling plans and analysis methods used.
- if the raw results are not going to be presented, should include a description of the data-reduction procedures

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.2 METHOD

A scheme of the employed experimental system is shown in Fig. 1.

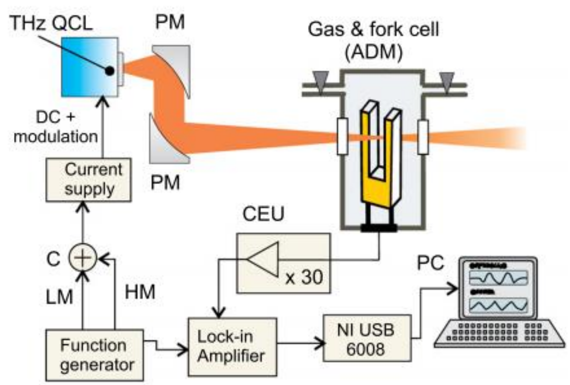

FIG. 1. Schematic of THz QCL-based QEPAS sensor. PM—paraboloidal mirror; C—power combiner; LM, HM—low-frequency modulation (triangular ramp), high-frequency modulation; CEU—control electronics unit; PC—personal computer.

A single-mode 250 μm wide, 1.5 mm long bound-to-continuum Fabry-Perot QCL fabricated in a single plasmon configuration and emitting at 3.93 THz (76.3 μm) (Ref. 22) was mounted on the cold finger of a continuous-flow cryostat equipped with polymethylpentene (TPX) windows (~70% transmission) and kept at a heat sink temperature of 6 K, while driven in CW mode. Despite the few hundreds Hz intrinsic linewidth,[4] due to temperature and electrical bias fluctuations the free running linewidth exceeds 1 MHz over few seconds time scale.[23]

By using a calibrated pyroelectric power meter, we measured a CW output power of 180 μW at 770 mA injected current. The THz beam was collimated using a 2 in. diameter (f/# = 1) 90° off-axis paraboloidal reflector and focused by a second reflector (2 in. diameter, f/# = 3) between the two prongs of the tuning fork, housed in a acoustic detection module (ADM) with TPX input and output windows. We achieved a focused beam waist radius of ~240 μm, as measured with a pyroelectric camera. By measuring the radiation power transmitted through the QTF using a pyroelectric detector, we verified that ~100% of the incoming laser beam was transmitted through the prongs without hitting the QTF.

DESCRIPTION OF THE EXPERIMENTAL SETUP

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.2 METHOD

QEPAS experiments were performed by applying a sinusoidal modulation to the QCL current at the QTF resonance frequency f_0, while detecting the QTF response at the same frequency by means of a lock-in amplifier. QEPAS spectral measurements were performed by slowly scanning the laser wavelength over $\sim$0.025 cm^{-1}, applying a low-frequency (10 mHz) voltage ramp to the external analog modulation input of the current supply (ILX-LDX 3232, bandwidth 0 Hz – 250 kHz). By means of a power combiner (DC to 12 GHz), the sinusoidal dither at f_0 is added to the low-frequency voltage ramp, to obtain up to 0.01 cm^{-1} optical frequency modulation. QEPAS measurement in locked-mode was performed by keeping fixed the laser wavelength on the absorption peak frequency and modulating its current at f_0. The lock-in amplifiers and a function generator (Tektronix model AFG3102) are controlled through a universal serial bus National Instruments card, respectively, using LABVIEW-based software. The piezoelectric signal generated by the QTF is amplified by a custom transimpedance amplifier (feedback resistor $R_{fb} = 10$ MΩ, gain = 30). The control electronics unit (CEU) is used to determine the QTF parameters: dynamic resistance R, Q-factor, and f_0. Unless differently specified, the lock-in time constant was set to 50 ms, corresponding to a bandwidth of 3.335 Hz.

To test our sensor, we selected methanol. In the laser emission range methanol exhibits a rotational absorption line falling at 131.054 cm^{-1} (v = 1, K = 6, J = 11) ← (1, 5, 10) with line-strength $S = 4.28 \times 10^{-21}$ cm/molecule, about two orders of magnitude stronger than that of the nearby methanol absorption lines.[24,25] Thus, we performed direct absorption spectroscopic measurements (using a 14 cm-long cell filled with pure methanol at 2 Torr) and, as expected, we observed a main absorption line. The line-strength extracted from absorption measurements was in good agreement with the expected one. So in our QEPAS experiments we exploit the absorption measurement to fine tune the laser frequency on the selected methanol absorption line at 131.054 cm^{-1}.

Gas mixtures with different methanol concentrations have been obtained by diluting methanol vapors, collected from a reservoir held at the vapor pressure ($\sim$120 Torr at 300 K), with pressurized N_2. For measurements at low concentrations, we used a certified 100 ppm methanol/N_2 gas mixture. Preliminary measurements were performed to determine the best operating conditions in terms of QEPAS signal-to-noise, as a function of gas pressure, laser current modulation depth and resonance frequency. Note that the possibility to use a lower resonance frequency with respect to standard QTF, partially relaxes the gas excess energy relaxation time requirements and allows to work at low pressures, taking advantages of the corresponding larger Q factors. The best operating conditions have been observed at 10 Torr pressure and 600 mV peak-to-peak modulation voltage. Under these conditions, the physical parameters of the QTF, using N_2 as gas carrier, were $Q = 76300$, $f_0 = 4246.73$ Hz, and $R = 6.5$ MΩ. From these data, we extracted a QTF thermal noise of 0.12 μV, about one order of magnitude smaller than that typically observed for standard QTFs.[15,18]

DESCRIPTION OF THE TECHNIQUE

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.3 RESULTS AND DISCUSSION

The results of a paper, if included as its own section, should be very short. It is simply a presentation of the results obtained corresponding to the methods described in the previous section, organized to make them accessible to the reader.

Often, these results are presented in **tables** and/or **graphs**. Well-crafted tables and figures require very little in terms of supporting text in the body of the paper, so the results are usually combined with a discussion of them in the results and discussion section.

An important goal when presenting results is to clearly designate those results that are new (never before published), while properly citing results that have been previously published.

This discussion generally passes through the stages of summarizing the results, discussing whether results are expected or unexpected, comparing these results to previous work, interpreting and explaining the results (often by comparison to a theory or model), and hypothesizing about their generality.

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.3 RESULTS AND DISCUSSION

The Discussion section inverts the format of the introduction, moving from the specific (the results generated in this work) to the general (how these results demonstrate a general principle that is more widely applicable).

Any problems or shortcomings encountered during the course of the work should also be discussed, especially if they might influence how results are to be interpreted.

Some common pitfalls when writing the results and discussion section are:

- lack of organization
- presenting results that are never discussed
- presenting discussion that does not relate to any of the results
- presenting results and discussion in chronological order rather than logical order, ignoring results that do not support the conclusions, or drawing conclusions from results without sound logical arguments to back them up.

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.3 RESULTS AND DISCUSSION

A representative spectral scan of 0.75% methanol in N_2 gas mixture is shown in Fig. 2(a). With a pressure broadening coefficient of 10 MHz/Torr (7.4 MHz/millibar) (Ref. 26) the expected line-width is ~100 MHz (half width at half maximum, HWHM), with a negligible Doppler contribution (4.5 MHz HWHM). We used this estimate to convert the horizontal scale from time to frequency span (MHz). Note that the laser linewidth is much lower than the spectral line width of the methanol absorption feature. On the same energy span, in Fig. 2(b) are reported the line-strengths of the main methanol transitions (vertical bars), as tabulated in the Jet Propulsion Laboratory (JPL) database.[25] In the inset of Fig. 2(a) is shown a QEPAS spectral scan obtained for a certified 100 ppm methanol in N_2 gas mixture, using a 3 s lock-in integration time. Considering the noise fluctuations $\pm 25\,\mu V$ and the QEPAS peak signal for 100 ppm methanol concentration ($\sim 170\,\mu V$), we can extract for our THz QEPAS sensor a 1σ detection limit of ~15 ppm at 3 s integration time.

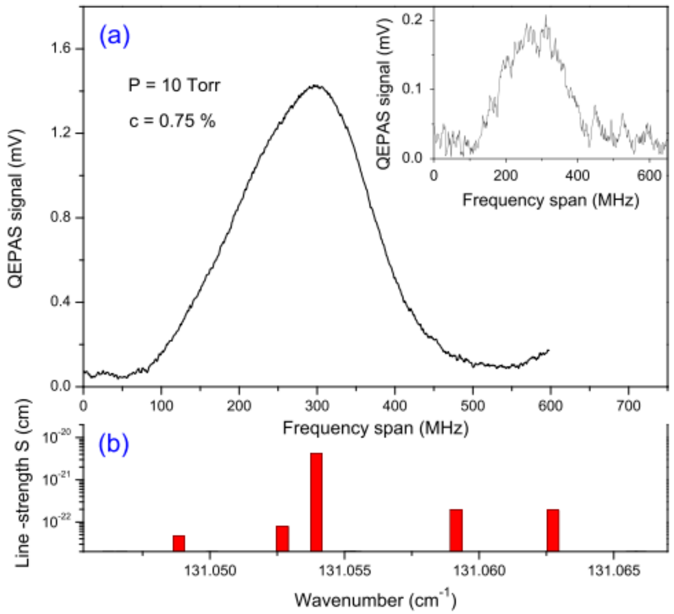

FIG. 2. (a) Spectral scan of 0.75% methanol in N_2 at P = 10 Torr, acquired with a modulation depth of 12 mA (~100 MHz) and 500 ms integration time. Inset: QEPAS acquisition of a methanol/N_2 sample with a certified concentration of 100 ppm and lock-in integration time of 3 sec. The noise fluctuations are $\sim \pm 25\,\mu V$. (b) Line strengths of the main methanol transitions (vertical bars), as reported in the JPL database,[25] falling in the energy range corresponding to the frequency span of Fig. 2(a).

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.3 RESULTS AND DISCUSSION

Stepwise concentration measurements were performed to verify the linearity of the QEPAS signal as a function of the methanol concentration. The system was operated in the locked mode, i.e., with the QCL frequency set to the center of the absorption line. Under this condition an optical laser power of 40 μW is focused on the QTF. In Fig. 3, the mean value of the QEPAS peak signal is plotted for different methanol concentrations from 6.5% down to 0.01% (100 ppm). The associated error bars take into account both the QEPAS signal fluctuations (standard deviation) and the uncertainty on the methanol concentration (uncertainty on the reading of the pressure gauge of $\pm$0.2 Torr). The experimental data show the expected linear dependence of the QEPAS signal from the methanol concentration.

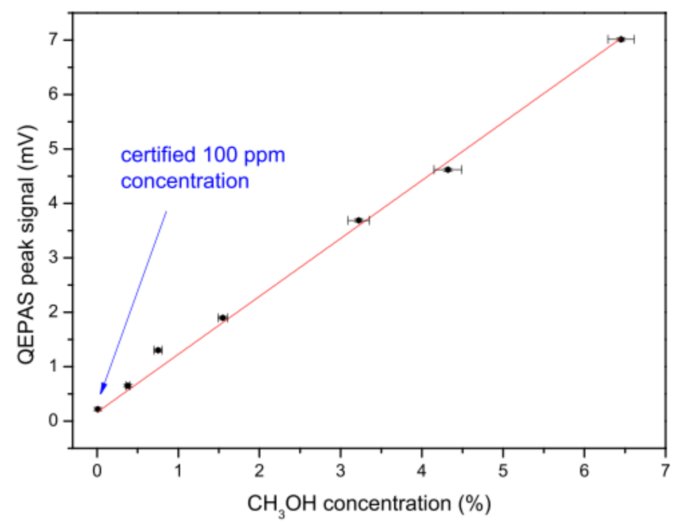

FIG. 3. Mean value of the QEPAS peak signals measured for gas mixture samples with different methanol concentrations in locked mode at 10 Torr pressure. The red line is a linear fit of the data ($R^2 = 0.9963$). The small deviations from the linear trend are partially due to uncertainty in the gas mixture concentration.

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7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.3 RESULTS AND DISCUSSION

In order to determine the best achievable sensitivity of the QEPAS sensor we performed an Allan variance analysis measuring and averaging the QEPAS signal at zero methanol concentration (pure N_2). The obtained Allan deviation in ppm is shown in Fig. 4. For a 4 sec averaging time (i.e., 0.04 Hz bandwidth), we achieve a detection sensitivity of 7 ppm, corresponding to a minimum absorption coefficient $\alpha_{min} = 9.5 \times 10^{-7}\,cm^{-1}$ (laser power of $\sim 40\,\mu W$). The calculated NNEA is $2 \times 10^{-10}\,cm^{-1}W/Hz^{1/2}$ (1σ), comparable with the best result obtained in the mid-IR[18] and at least one order of magnitude better than those obtainable with room-temperature pyroelectric detectors and in strong competition with the sensitivities achieved with the most sensitive cryogenic bolometers.

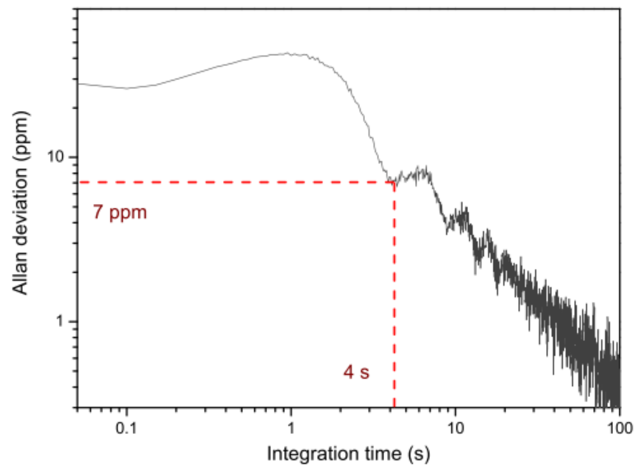

FIG. 4. Allan deviation in ppm of the QEPAS signal as a function of the integration time. The initial growth from 0.1 to 1 s reflects delays due to the signal sampling time (200 ms). The oscillations at integration time larger than 4 s are due to slow mechanical drifts of the ADM mounting.

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.4 CONCLUSIONS

The Conclusions section provides a brief summary of the results and discussion, but it should be more than a summary.

After showing how each research question posed in the introduction has been addressed, the implications of the findings should be emphasized, explaining how the work is significant. The goal here is to provide the most general claims that can be supported by the evidence.

The Conclusions section should allow for opportunistic reading. When writing this section, imagine a reader who reads the introduction, skims through the figures, then jumps to the conclusion.

The first goal of the conclusion is to concisely provide the key message(s) the author wishes to convey. It should not repeat the arguments made in the results and discussion, only the final and most general conclusions.

The second goal of the conclusion is to provide a future perspective on the work. This could be recommendations to the audience or a roadmap for future work. .

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.4 CONCLUSIONS

In conclusion, we extend the possibility to employ the QEPAS technique in the THz spectral range, using a THz QCL source and a custom QTF. The simple apparatus architecture and the independence of the detection unit from the laser frequency make the proposed sensor highly versatile in the spectral domain actually accessible to THz QCLs. In addition, the possibility to employ high power CW ($\sim$100 mW) THz QCLs for the detection of strong THz absorbing molecules like OH or HF, having line-strengths of the order of 10^{-18} cm, would allow QEPAS detection sensitivity in the few parts per trillion concentration range. Furthermore, the possibility to implement compact QEPAS THz systems, with no optical detector needed, based on portable closed-cycle Stirling cryo-cooler opens the way to the use of THz sensor systems for in-situ security and environmental monitoring.

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.2.5 ABSTRACT

Although the abstract is the first part of a paper, it is usually the last part written

The abstract should answer two questions concisely:

- **What you did?**
- **What did you get?**

Details should therefore be avoided. Only the results / comments that are considered representative of the work for a reader should be included.

Almost all journals impose a maximum number of words for the Abstract.

A quartz enhanced photo-acoustic sensor employing a single-mode quantum cascade laser emitting at 3.93 Terahertz (THz) is reported. A custom tuning fork with a 1 mm spatial separation between the prongs allows the focusing of the THz laser beam between them, while preventing the prongs illumination. A methanol transition with line-strength of 4.28×10^{-21} cm has been selected as target spectroscopic line. At a laser optical power of $\sim 40\ \mu$W, we reach a sensitivity of 7 parts per million in 4s integration time, corresponding to a 1σ normalized noise-equivalent absorption of $2 \times 10^{-10}\,\text{cm}^{-1}\text{W/Hz}^{1/2}$. © *2013 AIP Publishing LLC*. [http://dx.doi.org/10.1063/1.4812438]

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7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.3 LANGUAGE AND STYLE

"Have something to say, and say it as clearly as you can. That is the only secret of style."

—Matthew Arnold

Style is a layered concept and learning to improve your style means mastering words and grammar first, clear and accurate sentences next, then paragraphs that communicate complex thoughts well, and finally an organized whole that contributes to the accumulated knowledge of science.

The purpose of a research paper is to present some new result, explain its significance, and place it coherently within the existing body of knowledge.

Many common "rules" of good writing :

- do not use the passive voice
- avoid complex noun phrases
- make the action involve people

generally do not apply to the scientific style.

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.3 LANGUAGE AND STYLE

For example, the scientific stance on truth makes the scientist replaceable; anybody could have done the same experiments/derivations/simulations. To emphasize this important philosophy, scientists attempt to remove themselves from the discussion. .

Instead of saying:

"We performed an experiment"

Which puts the authors front and center, we regularly use the passive voice:

"An experiment was performed"

That does not mean first-person pronouns are forbidden.

Although anyone could have performed that experiment, it is the authors who are proposing a new approach, encouraging a new direction, or suggesting a new design. In these cases, the authors are not replaceable, and their voices are allowed to come through.
Using “I” or “we” in the introduction and conclusions is common, but not in the experimental or results sections.

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.3 LANGUAGE AND STYLE

The scientific style also tends to pack complexity into its nouns (and noun phrases) rather than into the structure of a sentence.

Consider this sentence with only simple words:

"Jane saw Bob on the hill with the telescope.."

The embedded clauses create ambiguity (who has the telescope?), and it is ambiguity, not complexity, that the scientific style shuns. .

Science writing frequently employs complex noun phrases in sentences with simple structures:

"Sidewall sensing in a CD-AFM involves continuous lateral dithering of the tip."

Unfortunately, some writers inflate their language in an attempt to sound more professional or profound. Which of these two sentences do you think is clearer?

"In Figure 2, the x and y axes represent the cavity diameter and the filling ratio, respectively."

"In Figure 2, the filling ratio is plotted as a function of the cavity diameter."

7.2 THE STANDARD STRUCTURE OF A SCIENTIFIC PAPER

7.3 LANGUAGE AND STYLE

A writer should try to teach the readers, not impress them.

The easiest way to do that is to draft the passage using the words that come most naturally, then revise, rewrite, and revise again with accuracy, precision, and clarity in mind.

Sleep on it, let someone else read it, then revise it again.

Writing is mostly the act of rewriting, and it is work.