

**Arzoumanian Emmanuel**  
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## Education

**Ph.D., Chemistry and Physics.** Paris 7 and Paris East Universities, 2010

**Masters, Environmental Sciences and Engineering.** Paris 7 Univ, 2007 - *graduated top of class*

**B.S., Cellular and Molecular Biology.** Saint Joseph University, Beirut, 2005

## Expertise

**Software:** Python, R, MATLAB, LabView, OriginLab, Fortran, Lagrangian (particle dispersion) models, Eulerian (chemistry-transport) models, AWS Cloud Computing.

**Instrumentation techniques:** FTIR, IR/VIS/VUV-UV Spectroscopy, Cavity Ring Down Spectroscopy, GC-MS, LC-MS, HPLC, UPLC, LIDAR, Fluorometry, Optical Emission Spectrometry, EPR Spectroscopy, NMR spectroscopy, Inductively Coupled Plasma - Mass Spectrometry (ICP-MS), Raman Spectrometry, ASS Spectroscopy, Refractometry, Ion Chromatography, Laser Flash Photolysis, Instrument Design and Development, Photonics and Dye lasers, laser interferometry, Laser-Induced Fluorescence, Photochemistry, Corona Discharge, EPR-spin trapping detection, actinometry, low-noise RF electronics, nonlinear optics, cryogenics, UVH vacuum systems, CF and KF systems, vibration isolation, Synchrotron radiation, Organic Synthesis, Electrophoresis, ELISA, PCR, Cellular culture.

**Languages:** Fluent in English, French, Armenian, and conversational Spanish

## Experience

**CEA (French Atomic Energy Commission), Greater Paris, France**

**Research Scientist** 2013 – 2019

- Engineered and built fully automated instruments using commercial NDIR sensor, humidity / temperature / pressure sensors, pump, acquisition unit. Compared the instruments to highly precise IR spectroscopy analyzers and developed correction-calibration strategies. Data analysis using MATLAB and Python. Showed the feasibility of using the engineered instruments for urban CO<sub>2</sub> monitoring networks after containing residual errors within the  $\pm 1$  ppm target. Results are published in Atmos. Meas. Tech. 2019, (12), 2665–2677
- Data analysis of Green House Gas (GHG) emissions in greater Paris area using chemistry-transport 3D models and Lagrangian particle dispersion models. Validated GHG inventories by comparing observations and models.
- Maintained and calibrated analytical instrumentation (CRDS, FTIR, HPLC, GC-MS, LC-MS, Dye Lasers, UV/VIS Spectrometers). Installed new laboratory equipment. Managed chemical and supply inventories. Selected and negotiated pricing for hardware, instruments and consumables. Prepared weekly projects updates and maintained notebooks.
- Developed and validated analytical and wet chemistry methods. Trained and provided technical guidance to associate scientists.

**CEA – SUEZ partnership, Greater Paris, France**

**R&D Scientist** 2016 - 2018

- WasteMiti Project leader: Assessed fugitive GHG emissions from a waste landfill (Butte-Bellot - Paris area).
- Developed and lead a study presenting a new concept for estimating pollutant emission rates of a site and its main facilities by using a series of atmospheric measurements across the pollutant plumes. This concept combines a tracer release method, local-scale atmospheric transport modeling and a statistical atmospheric inversion approach. Results are published in Atmos. Meas. Tech. 2017, (10), 5017

**IMRCP** (Molecular Interactions, Photochemical and Chemical Reactivity Laboratory), Toulouse, France

**Post-doctoral fellow** 2011 – 2013

- Studied mechanisms of photochemistry at gas-solid interfaces. Determined singlet oxygen lifetimes and quantum yields of singlet oxygen production.
- Conducted research studies on cancerous cell treatments using singlet oxygen.
- Synthesized small molecules and silica polymers combined with organic dyes (sol-gel method). Showed that the synthesized polymers can be used as microphotoreactor for O<sub>2</sub>-mediated oxidation of volatile pollutants and cancer treatment. Results are published in ACS Applied Materials & Interfaces 2014, (1), 275-288.
- Designed and built time-resolved and steady-state optical benches using UV/VIS and Raman spectrometry, Laser induced Fluorescence, Laser Flush Photolysis.

**IPSL** (Institut Pierre Simon Laplace), Greater Paris, France.

**Ph.D. Researcher** 2007 – 2011

- Built a simulation chamber to study Titan's (Saturn's largest moon) atmosphere. Components of the chamber: FTIR and Fluorescence spectrometers, Pressure and Flow controllers, CF and KF components, UltraVacuum pumps, Cryogenic traps, Fully engineered Photochemical H<sub>2</sub>/He lamp, YAG Laser, IR detectors.
- Implemented methane irradiations at 121.6 nm (1 photon absorption) and 248 nm (2 photons absorption). Detection techniques: FTIR, and GCMS. Data Analysis using Python and R. Interpreted results using a zero dimension chemistry model. Results are published in Planet. Space Sc., 2010, (58), 1748
- Designed and analyzed experiments on Bessy synchrotron facility. Built ultra vacuum (10E-10 mbars) chambers, installed KF and CF components, cryogenic systems.
- Measured cross sections of C<sub>4</sub>H<sub>2</sub>, HCN, HC<sub>5</sub>N in the mean infrared. Designed and engineered a vacuum spectroscopy FTIR cell. Organic synthesis of C<sub>4</sub>H<sub>2</sub>, HCN, HC<sub>5</sub>N. Results are published in Journal of Geophysical Research Planets, 2010, (115), 6.
- Pursued experimental and theoretical studies in the areas of plasma physics, particle acceleration, and particle beam-plasma interactions.

**Saint Joseph University**, Beirut, Lebanon.

Laboratory Assistant 2003-2005

- In charge of experiments for teaching purposes: PCR, Cell Culture, Western Blot, ELISA, Cell Based Assay, Flow Cytometry, DNA Sequencing, Gel assays.

**Teaching Experience** 2007 – 2011

- Created and taught (500 hours) analytical chemistry, IR and UV spectroscopy. Courses for undergraduate and senior students.
- Lectured Ph.D. level astrochemistry courses on Titan's atmosphere. Taught development of workflows to detect asteroids and exoplanets using virtual observatories (25 hours).

### **Peer Reviewed Publications**

**E. Arzoumanian**, F. R. Vogel, A. Bastos, B. Gaynullin, O. Laurent, M. Ramonet, and P. Ciais: Characterization of a commercial lower-cost medium-precision non-dispersive infrared sensor for atmospheric CO<sub>2</sub> monitoring in urban areas, Atmos. Meas. Tech. 2019, (12), 2665–2677.

S. Ars, G. Broquet, C. Yver Kwok, Y. Roustan, L. Wu, **E. Arzoumanian**, and P. Bousquet: Statistical atmospheric inversion of local gas emissions by coupling the tracer release technique and local-scale transport modelling: a test case with controlled methane emissions, Atmos. Meas. Tech. 2017, (10), 5017.

**E. Arzoumanian**, F. Ronzani, A. Trivella, E. Oliveros, M. Sarakha, C. Richard, S. Blanc, T. Pigot and S. Lacombe. Transparent Organosilica Photocatalysts Activated by Visible Light: Photophysical and Oxidative Properties at the Gas Solid Interface. *ACS Applied Materials & Interfaces* 2014, (1), 275-288.

C. Lorente, **E. Arzoumanian**, C. Castan, E. Oliveros and A. H. Thomas. A non-singlet oxygen mediated reaction photoinduced by phenalenone, a universal reference for singlet oxygen sensitization. *Royal Society of Chemistry Adv.* 2014, (4), 10718.

A. Trivella, S. Monadjemi, D. Worrall, I. Kirkpatrick, **E. Arzoumanian**, C. Richard Perinaphthenone phototransformation in a model of leaf epicuticular waxes. *Journal of Photochemistry and Photobiology B: Biology* 2014, (130), 93–101.

F. Ronzani, **E. Arzoumanian**, S. Blanc, P. Bordat, T. Pigot, C. Cugnet, C. Richard, E. Oliveros, M. Sarakha, S. Lacombe. Efficient cyanoaromatic photosensitizers for singlet oxygen production: synthesis and characterization of the transient reactive species. *Phys. Chem. Chem. Phys.*, 2013, (15), 17219-17232.

S. Bouchama, P. de Sainte-Claire, **E. Arzoumanian**, A. Boulkamh and C. Richard. Photoreactivity of the fungicide chlorothalonil in aqueous medium. *Environ. Sci.: Processes Impacts*, 2014, (16), 839.

F. Ronzani, P. Saint-Cricq, **E. Arzoumanian**, T. Pigot, S. Blanc, M. Oelgemöller, E. Oliveros, C. Richard, S. Lacombe. Immobilized organic photosensitizers with versatile reactivity for various visible-light applications. *Photochem Photobiol.* 2014, (90), 358.

F. Ronzani, A. Trivella, **E. Arzoumanian**, S. Blanc, M. Sarakha, C. Richard, E. Oliveros and S. Lacombe. Comparison of the photophysical properties of three phenothiazine derivatives: transient detection and singlet oxygen production. *Photochem. Photobiol. Sci.*, 2013, (12), 2160-2169.

C. Romanzin, **E. Arzoumanian**, E.T. Es Sebbar, S. Perrier, M.-C. Gazeau and Y. Bénilan. Combined experimental and theoretical studies on methane photolysis at 121.6 nm and 248 nm – implications on a program of laboratory simulations of Titan's atmosphere. *Planet. Space Sc.*, 2010, (58), 1748.

N. Fray, Y. Bénilan, M.-C. Gazeau, A. Jolly, M. Schwell, **E. Arzoumanian**, T. Ferradaz, E.T. Es-Sebbar, and J.-C. Guillemin. Temperature-dependent photoabsorption cross-section of cyanodiacetylene in the vacuum UV. *Journal of Geophysical Research Planets*, 2010, (115), 6.

### Selected Conference Presentations

**E. Arzoumanian**, B. Gaynullin, H. Martin, O. Laurent and F.R. Vogel. Developing a lower-cost medium precision urban GHG monitoring system using commercial NDIR sensors. *GGMT meeting*, September 2017, Zurich, Switzerland.

**E. Arzoumanian**, B. Gaynullin, H. Martin, O. Laurent and F.R. Vogel. An evaluation of commercial NDIR sensors for a potential use in future urban GHG monitoring systems. *AGU meeting*, December 2016, San Francisco USA

**E. Arzoumanian**, J.-D. Paris, A. Pruvost, S. Peng, S. Turquety, A. Berchet, I. Pison., M. Arshinov, and B. Belan. A comparative study of Siberian methane fluxes during the two YAK AEROSIB airborne campaigns of 2012 and 2013. *PEEX meeting*, February 2015, Helsinki, Finland.

Lorente C., **Arzoumanian E.**, Castano C., Oliveros E., Thomas A. H. A non-singlet oxygen mediated reaction photoinduced by phenalenone, a universal reference for singlet oxygen sensitization. *ELAFOT XII*, April 2015, Sao Paulo, Brazil

**E. Arzoumanian**, F. Ronzani, S. Blanc, T. Pigot, S. Lacombe, E. Oliveros. Production of singlet oxygen by photosensitizers in liquid phase and at solid/gas interfaces. 22-23 November 2012, Paris.

**E. Arzoumanian**, C. Romanzin, M.-C. Gazeau, Et. Es Sebbar, A. Jolly, S. Perrier, Y. Benilan. Contributions to the Development of the S.E.T.U.P. (Experimental and Theoretical Simulations Useful for Planetology) Project. *DPS meeting*, Fajardo, 4-9 October 2009.

**Arzoumanian E.**, Es-sebbar Et., Romanzin C., Perrier S., Gazeau M.-C., Benilan Y. Preliminary studies for the development of S.E.T.U.P. Experimental and Theoretical Simulations Useful for Planetology. *Planetary Science Congress*, 21-26 September 2008, Munster.