CHRISTIAN L. GOUEGUEL

Montréal, QC H3T 1S5

☎ (602) 684-9837 ✉: christian.goueguel@gmail.com

PROFESSIONAL SUMMARY

Experienced in spearheading innovative research and development initiatives within the realm of optical spectroscopy and analytical chemistry. Proficient in managing and leading multidisciplinary teams to drive the development of advanced analytical tools and methodologies. Demonstrated expertise in applying technologies such as Laser-Induced Breakdown Spectroscopy (LIBS) and Inductively Coupled Plasma (ICP) spectroscopy to achieve highly sensitive chemical analysis. Proven track record of leveraging machine learning and chemometric approaches to optimize experimental protocols and enhance accuracy in quantitative analysis. Adept at collaborating with cross-functional teams and external stakeholders to integrate novel solutions into real-world applications, ultimately driving impactful results in diverse scientific domains.

AREA OF EXPERTISE

Advanced Laser Spectroscopy | Chemometric Modeling | Experimental Design and Execution | Team Leadership and Collaboration | Technology Integration | Data Analysis and Interpretation | Project Management | Scientific Communication | Regulatory Compliance | Innovation and Problem-Solving

PROFESSIONAL SKILLS

- Expertise in managing and leading multidisciplinary teams for the development of advanced laser plasma tools.
- Advanced skills in Laser-Induced Breakdown Spectroscopy (LIBS) and femtosecond and nanosecond laser ablation.
- Proficiency in Inductively Coupled Plasma (ICP) spectroscopy.
- Ability to apply innovative analytical chemistry concepts to develop highly sensitive chemical analysis techniques.
- Experience in integrating cutting-edge technologies for real-time analysis and monitoring in scientific research.
- Strong collaboration skills to work effectively with cross-functional teams and external partners in diverse research environments.

TECHNICAL SKILLS

- **Project Management** (Jira, MS Project)
- **Optics/Photonics**
- **Optical Spectroscopy** (ICP-OES, LIBS, NIRS)
- **Chemometrics/Machine Learning**
- **Data Mining**
- **Multivariate Statistics**
- **Design of Experiments**
- **Programming Languages** (R, Python, MATLAB)

CAREER HISTORY

Chemometrics Consultant   Sep. 2023 – Feb. 2024
Montreal, QC, Canada

- Collaborated with an optical sensing solution provider to develop chemometric and machine learning models utilizing spectral data collected from milk samples via a near-infrared spectroscopy (NIRS) device.
- Conducted comprehensive data analysis on milk samples to extract meaningful insights and optimize chemometric algorithms for accurate prediction of five milk components (protein, lactose, urea nitrogen, fat, and somatic cell count).
- Leveraged advanced statistical techniques to preprocess NIRS spectral data, including noise reduction, baseline correction, and outlier detection, ensuring high-quality input for model development.
- Developed and implemented custom chemometric models tailored to specific project requirements, effectively addressing challenges such as orthogonal variability and matrix effects.
- Worked closely with a cross-functional engineering team to integrate chemometric solutions into the optical sensing platform, enhancing its capabilities for real-time analysis and monitoring in dairy production environments.

Principal Scientist   Nov. 2022 – Sep. 2023
Logiag Inc., Chateauguay, QC, Canada

- Spearheaded experimental initiatives to conduct comprehensive studies focusing on the quantitative analysis of total carbon content in agricultural soils leveraging the laser-induced breakdown spectroscopy (LIBS) technique.
- Innovatively developed and implemented machine learning models to assess and track carbon storage levels within soil samples, aligning with the distinct criteria outlined by the Quebec carbon market.
- Directed and supervised a team of engineers in executing experimental protocols, ensuring accuracy and reliability in data collection and analysis.
- Collaborated cross-functionally with internal teams and external stakeholders to integrate the LIBS platform and methodologies into the customers' framework, optimizing efficiency and effectiveness.
- Generated detailed reports and presentations summarizing experimental findings, methodologies, and actionable insights for internal review and external dissemination.

Senior Optical Engineer   Sep. 2021 – Nov. 2022
Atonarp Inc., Scottsdale, AZ, USA
- Spearheaded the research and development efforts for a point-of-care (POC) medical device leveraging laser-induced breakdown spectroscopy and coherent anti-Stokes Raman spectroscopy techniques.
- Innovatively designed and constructed an in-house optical microfluidic sensing benchtop platform from scratch to enable the precise and reliable quantification of dissolved analytes in simulated body fluids.
- Engineered the platform to replicate real-world measurement conditions, ensuring the development of a durable and economical POC device.
- Led a multidisciplinary team in the optimization of optical components and systems for enhanced sensitivity and accuracy in chemical analysis.
- Collaborated closely with a cross-functional engineering team to integrate optical sensing technologies into the overall device architecture, ensuring seamless functionality and performance.
- Conducted rigorous testing and validation procedures to validate the performance and reliability of the optical sensing platform, adhering to regulatory standards and industry best practices.

R&D Scientist   Mar. 2018 – Sep. 2021
Logiag Inc., Chateauguay, QC, Canada
- Spearheaded the development of a benchtop analytical instrument utilizing laser-induced breakdown spectroscopy technology for precise quantitative analysis of nutrients within agricultural soils and plant tissues.
- Integrated advanced chemometric and machine-learning methodologies into the instrument's design to enhance accuracy and precision.
- Directed the R&D lifecycle, overseeing the formulation of robust multivariate calibration models tailored to individual customer requirements.
- Continuously refined the measurement procedure to optimize performance and ensure consistency.
- Expanded the company's service portfolio by introducing the capability to accurately predict the textural class of agricultural soils, enhancing our value proposition to clients.
- Authored and published a groundbreaking research article and a book chapter, contributing to the scientific community's understanding of soil analysis methodologies.
- Elevated Logiag's reputation within the scientific community through notable recognition in the Journal of Analytical Atomic Spectrometry for our pioneering work on predicting soil particle size fractions, showcased prominently on the back cover of vol. 34:8 (2019).

Orise Research Fellow   Nov. 2014 – Jun. 2017
National Energy Technology Laboratory, Pittsburgh, PA, USA
- Conducted research and development to design a rugged and compact subsurface all-fiber-coupled laser-induced breakdown spectroscopy sensor tailored for carbon capture and storage measurements and monitoring tasks in environments characterized by high temperature, pressure, and salinity waters.
- Developed chemometric models to enhance the accuracy and precision of carbon capture and storage measurements.
- Engineered a diode-pumped passively Q-Switch laser by assembling a setup comprising a 10mm Nd:YAG crystal and a 6mm Cr:YAG passive Q-switch.
- Published 10 peer-reviewed research articles, a conference proceeding, and a book chapter, showcasing expertise in scholarly communication and dissemination of groundbreaking research findings.
- Led a groundbreaking research project focusing on the development of an underwater LIBS system to monitor the dissolution of carbonate minerals under rising CO_2 pressure, resulting in the feature of our work on the front cover page of the prestigious Journal of Analytical Atomic Spectrometry, 31:7 (2016), highlighting significant contributions to the field of analytical chemistry.

Postdoctoral Research Associate   Aug. 2012 – Nov. 2014
Carnegie Mellon University, Pittsburgh, PA, USA
- Investigated and developed innovative analytical solutions for real-time, on-site tracking of CO_2 into the vadose zone and neighboring shallow groundwater systems, assessing environmental acidification, metals release, and saline groundwater migration during CO_2 geological storage.
- Conducted thorough investigations to demonstrate the efficacy of LIBS technology for in-situ measurements of alkali and alkaline earth metals in high salinity waters under high CO_2 pressures, both in CO_2-rich liquid phases and in CO_2-rich gaseous phases mixed with co-existing water.
- Published three peer-reviewed research articles in top-tier journals and presented findings at seminars and international conferences to disseminate research outcomes and contribute to the academic community's knowledge base.

Graduate Research Assistant   **Sep. 2006 – Jan. 2012**
National Research Council Canada, Boucherville, QC, Canada

- Conducted experimental investigations on the emission characteristics and analytical performance of selective wavelength approaches in LIBS for trace elements analysis in metallic alloys.
- Explored the effectiveness of LIBS combined with laser-induced fluorescence (LIBS-LIF), resonance-enhanced LIBS (RELIBS), and resonant LIBS (RLIBS) to enhance absolute and relative limits of detection in trace impurity analysis.
- Authored and published 4 peer-reviewed research articles in top-tier journals and presented findings in 2 peer-reviewed conference proceedings.
- Developed and proposed an efficient excitation-fluorescence scheme for single-element determination or sequential analysis using a single tunable laser and Stokes direct-line fluorescence detection, extending the application of the RLIBS approach.
- Achieved recognition for research on resonance-enhanced LIBS, featured on the inside front cover page of the Journal of Analytical Atomic Spectrometry, 25:5 (2010).
- Received the LIBS2010 Student Poster Award, securing 1st prize for exemplary research contributions.

EDUCATION

PhD, Physics – INRS University, Varennes, Canada   2012
MEng, Signal Processing – Grenoble Alpes University, Grenoble, France   2006
MSc, Physics – Grenoble Alpes University, Grenoble, France   2005
BSc, Physics– University of Picardy Jules Verne, Amiens, France   2003

CERTIFICATION AND AFFILIATIONS

Certifications: Machine Learning, Stanford Online • Neural Networks and Deep Learning, deeplearning.ai • Structuring Machine Learning Projects, deeplearning.ai
Affiliations: Society for Applied Spectroscopy (SAS), member • The Optical Society (OSA), member

SYNERGISTIC ACTIVITIES AND PUBLICATIONS

SYNERGISTIC ACTIVITIES
Journal Reviews: J. Anal. At. Spectrom., ChemComm, Appl. Opt., Photonics Research, Opt. Lett., and Opt. Express

BOOK CHAPTERS
- C.R. Bhatt, C.L. Goueguel, J.C. Jain, D.L. McIntyre, J.P. Singh, LIBS application to liquid samples In: Laser-Induced Breakdown Spectroscopy (2nd Edition), Elsevier Science, 2020
- D.L. McIntyre, J.C. Jain, C.L. Goueguel, J.P. Singh, Application of Laser-Induced Breakdown Spectroscopy (LIBS) to Carbon Sequestration Research and Development In: Spectroscopic Techniques for Security, Forensic and Environmental Applications, Nova Science Publishers, 2014

ARTICLES
- **[Cover Art]** C.L. Goueguel, A. Soumare, C. Nault, J. Nault, Direct determination of soil texture using laser-induced breakdown spectroscopy and multivariate linear regressions, Journal of Analytical Atomic Spectrometry 34, 2019
- C.L. Goueguel, C.R. Bhatt, J.C. Jain, C.L. Lopano, D.L. McIntyre, Quantification of dissolved metals in high-pressure CO_2-water solutions by underwater laser-induced breakdown spectroscopy, Optics & Laser Technology 108, 2018
- C.R. Bhatt, J.C. Jain, C.L. Goueguel, D.L. McIntyre, J.P. Singh, Determination of rare earth elements in geological samples using laser-induced breakdown spectroscopy (LIBS), Applied spectroscopy 72, 2018
- C.R. Bhatt, J.C. Jain, C.L. Goueguel, D.L. McIntyre, J.P. Singh, Measurement of Eu and Yb in aqueous solutions by underwater laser-induced breakdown spectroscopy, Spectrochemical Acta Part B: Atomic Spectroscopy 137, 2017
- C.R. Bhatt, C.L. Goueguel, J.C. Jain, H.M. Edenborn, D.L. McIntyre, Analysis of charcoal blast furnace slags by laser-induced breakdown spectroscopy, Applied Optics 56, 2017
- J.C. Jain, C.L. Goueguel, C.R. Bhatt, D.L. McIntyre, LIBS Sensor for Sub-surface CO_2 Leak Detection in Carbon Sequestration, Sensors & Transducers Journal 214, 2017
- J.C. Jain, D.L. McIntyre, C.L. Goueguel, Harsh environment low- cost LIBS sensor for sub-surface CO_2 leak detection in carbon sequestration, Materials for Energy, Efficiency, and Sustainability: TechConnect Briefs 2017
- **[Cover Art]** C.L. Goueguel, J.C. Jain, D.L. McIntyre, C.G. Carson, H.M. Edenborn, In situ measurements of calcium carbonate dissolution under rising CO_2 pressure using underwater laser-induced breakdown spectroscopy, Journal of Analytical Atomic Spectrometry 31, 2016
- C.L. Goueguel, D.L. McIntyre, J.C. Jain, Matrix effect of sodium compounds on the determination of metal ions in aqueous solutions by underwater laser-induced breakdown spectroscopy, Optics letters 41, 2016
- C.G. Carson, C.L. Goueguel, H. Sanghapi, J.C. Jain, D.L. McIntyre, Evaluation of a commercially available passively Q-switched Nd: YAG laser with LiF: F 2- saturable absorber for laser-induced breakdown spectroscopy, Optics & Laser Technology 79, 2016
- C.L. Goueguel, D.L. McIntyre, J.C. Jain, A.K. Karamalidis, C.G. Carson, Matrix effect of sodium compounds on the determination of metal ions in aqueous solutions by underwater laser-induced breakdown spectroscopy, Applied optics 54, 2015

- C.G. Carson, C.L. Goueguel, J.C. Jain, D.L. McIntyre, Development of laser-induced breakdown spectroscopy sensor to assess groundwater quality impacts resulting from geologic carbon sequestration, Micro-and Nanotechnology Sensors, Systems, and Applications VII 9467, 2015
- C.L. Goueguel, D.L. McIntyre, J.C. Jain, A.K. Karamalidis, Laser-Induced Breakdown Spectroscopy (LIBS) of a High-Pressure CO_2–Water Mixture: Application to Carbon Sequestration, Applied spectroscopy 68, 2014
- J.C. Jain, D.L. McIntyre, K. Ayyalasomayajula, V. Dikshit, C.L. Goueguel, F. Yu-Yueh, J.P. Singh, Application of laser-induced breakdown spectroscopy in carbon sequestration research and development, Pramana 83, 2014
- C.L. Goueguel, J.P. Singh, D.L. McIntyre, J.C. Jain, A.K. Karamalidis, Effect of sodium chloride concentration on elemental analysis of brines by laser-induced breakdown spectroscopy (LIBS), Applied spectroscopy 68, 2014
- C.L. Goueguel, S. Laville, F. Vidal, M. Chaker, M. Sabsabi, Resonant laser-induced breakdown spectroscopy for analysis of lead traces in copper alloys, Journal of Analytical Atomic Spectrometry 26, 2011
- F. Vidal, S. Laville, C.L. Goueguel, H. Loudyi, K. Rifai, M. Chaker, M. Sabsabi, A simple model of laser-induced fluorescence under arbitrary optical thickness conditions at the excitation wavelength, Journal of Quantitative Spectroscopy and Radiative Transfer 111, 2010
- [Cover Art] C.L. Goueguel, S. Laville, F. Vidal, M. Sabsabi, M. Chaker, Investigation of resonance-enhanced laser-induced breakdown spectroscopy for analysis of aluminum alloys, Journal of Analytical Atomic Spectrometry 25, 2010
- S. Laville, C.L. Goueguel, H. Loudyi, F. Vidal, M. Chaker, M. Sabsabi, Laser-induced fluorescence detection of lead atoms in a laser-induced plasma: An experimental analytical optimization study, Spectrochimica Acta Part B: Atomic Spectroscopy 64, 2009
- F. Vidal, M. Chaker, C.L. Goueguel, S. Laville, H. Loudyi, K. Rifai, M. Sabsabi, Enhanced Laser-Induced Breakdown Spectroscopy by Second-Pulse Selective Wavelength Excitation, AIP Conference Proceedings 1047, 2008
- C.L. Goueguel, S. Laville, H. Loudyi, M. Chaker, M. Sabsabi, F. Vidal, Detection of lead in brass by laser-induced breakdown spectroscopy combined with laser-induced fluorescence, Photonics North 2008, 709927, 2008