

# Dr. Christopher D. Alcorn

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## PROFILE

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**Research scientist** whose focus has been on aqueous physical chemistry, motivated by applications ranging from the high temperature and pressure coolant chemistry of industrial nuclear power generation stations to the modelling of *in vivo* detection of cancer markers.

**Multidisciplinary physical chemist** with a strong emphasis on obtaining quantitative thermodynamic data, with chemical interpretation supported by Density Functional Theory calculations (Gaussian 03, 09 & 16).

**Hands-on experience** in Raman,  $\mu$ SR (Muon Spin Resonance), NMR, ESR, densimetry and titration, with teaching experience in VT-NMR, IR, GC, GC-MS, HPLC, fluorometry, AA, UV-Vis and calorimetry.

**Experience** include roles such as guest lecturer, mentor and laboratory Instructor. Taught all aspects of physical and analytical chemistry to hundreds of students from 2009 to 2017.

**Proactive and systematic** in project research, methodology, experimentation and documentation.

## EMPLOYMENT

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**Postdoctoral Research Associate**, Los Alamos National Laboratory, Los Alamos, NM, USA.

March 2019 – Present.

**Contact: Dr. Artaches Migdisov, [artas@lanl.gov](mailto:artas@lanl.gov)**

**Postdoctoral Research Associate**, University of Guelph, Guelph, ON, Canada.

Sept. 2018 – Mar. 2019.

**Contact: Prof. Peter Tremaine, [tremaine@uoguelph.ca](mailto:tremaine@uoguelph.ca)**

## EDUCATION

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**Ph.D., Physical Chemistry**, University of Guelph, 2011 – 2018. GPA: 90 of 100

Dissertation Title: “A Quantitative Raman and Density Functional Theory Investigation of Uranyl Sulfate Complexation and Liquid-Liquid Phase Separation under Hydrothermal Conditions”

**Advisor: Prof. Peter Tremaine**

**M.Sc., Physical Chemistry**, Mount Allison University, 2008 – 2011. GPA: 3.6 of 4.3

Thesis Title: “Probing Aqueous Chemistry by Spin Spectroscopy: From Metabolites to the Safety of Nuclear Reactors”

**Advisor: Prof. Khashayar Ghandi**

**Hon. B.Sc., Mathematical Physics**, University of Toronto, 2001 – 2004. GPA: 2.9 of 4.3

Honours in Physics, Minor in Mathematics

## HONOURS, AWARDS AND GRANTS

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### **Best Ph.D. Student Contribution, 41<sup>st</sup> Annual CNS Student Conference, 2017**

Awarded by the Canadian Nuclear Society.

### **Queen Elizabeth II Graduate Scholarship in Science and Technology, 2013**

Awarded by the Office of Graduate Studies, University of Guelph.

### **University of Guelph Dean's Scholarship, 2011-2014**

Awarded by the Office of the Dean, University of Guelph.

### **Nominated for the Governor General's Gold Medal Award, Graduate Level, 2011**

### **National Research Council Research Fellowship Grant, 2008.**

## EXPERIENCE

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### **Guest Lecturer, Thermodynamics and Kinetics (CHEM 2820), University of Guelph, Fall 2014.**

### **Teaching Assistantships & Laboratory Instructor Positions, University of Guelph, 2011 – 2018.**

*Taught all aspects of physical and analytical chemistry to approximately 400 students.*

- **Chemistry Learning Center, Winter 2016 / Fall 2017 / Winter 2018**  
*Provided one-on-one mentorship available for all 2500+ students in the chemical sciences.*
- **Analytical Chemistry I (CHEM 2400), Winter 2014**  
*Developed analytical techniques; extraction, purification, gravimetric analysis, titration.*
- **Thermodynamics & Kinetics (CHEM 2820), Fall 2014 / 15 / 16**  
*Conducted bomb calorimetry, chemical kinetics and equilibria measured by physical chemical methods.*
- **Analytic Instrumentation (CHEM 3440), Fall 2013**  
*Instilled extended concepts from CHEM 3430 for design and optimization of chemical experimentation.*
- **Molecular Spectroscopy (CHEM 3870), Winter 2013 / 15 / 17**  
*Directed advanced experiments in IR, Raman, UV-Vis, NMR, and Variable Temperature NMR.*
- **Analytical Toxicology (TOX 3300), Fall 2012**  
*Supervised experiments in Fluorometry, GC, GC-MS, HPLC, AA, Voltammetry, and Ion-Selective Electrode.*
- **Instrumental Analysis (CHEM 3430), Winter 2012**  
*Oversaw GC, GC-MS, HPLC, AA, Cyclic Voltammetry, and Ion-Selective Electrode experiments.*
- **Introductory Chemistry (CHEM 1040), Fall 2011**  
*Supervised development of basic laboratory skills through introductory chemistry experiments.*

### **Teaching Assistantships and Laboratory Instructor Positions, Mount Allison University, 2009 – 2010.**

- **Physical Chemistry II (CHEM 3231), Winter 2010**
- **Physical Chemistry: Quantum (CHEM 3241), Fall 2010**  
*Taught a Gaussian 09 based laboratory; methods and basis sets, optimizations, vibrational calculations, NMR, ESR, transition states and thermochemistry.*
- **Physical Chemistry I (CHEM 2211), Fall 2009**

## PEER-REVIEWED JOURNAL ARTICLES

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**Alcorn, C., Migdisov, A.** “Uranyl Carbonate Complexation, Stability and Dissolution Kinetics under Hydrothermal Conditions”, *In Preparation*.

**Alcorn, C., Migdisov, A., Boufkalka, H.**, “Plutonyl Complexation versus pH under Hydrothermal Conditions by Quantitative Raman Spectroscopy”, *In Preparation*.

**Alcorn, C., Migdisov, A., Boufkalka, H.**, “Plutonyl Sulfate Complexation under Hydrothermal Conditions by Quantitative Raman Spectroscopy”, *In Preparation*.

**Alcorn, C., Baker, J., Migdisov, A., Boufkalka, H.**, “Plutonyl Chloride Complexation under Hydrothermal Conditions by Quantitative Raman Spectroscopy”, *Submitted*.

Kalintsev, A., Migdisov, A., **Alcorn, C.**, Baker, J., Brugger, J., Mayanovic, R., Akram, N., Xu, H., Boukhalifa, H., Caporuscio, F., Vishvanatan, H., Colon-Jove, C., Wang, Y., Matteo, E. and Roback, R., “Uranium Carbonate Complexes Demonstrate Drastic Decrease in Stability at Elevated Temperatures”, *Commun. Chem.* (2021), **4**, 120.

Migdisov, A., van Hartesveldt, N., Kalintsev, A., Nisbet, H., **Alcorn, C.**, Strzelecki, A., Ram R., Boukhalifa, H., Sauer, K., Xu, H., Gabitov, R., Brugger, J., Etschmann, B., Jove-Colon, C., Matteo, E.N., Caporuscio, F.A., Roback, R., and White, J., “An Unexplored Uranium Mobilization Pathway from Nuclear Waste Repositories”, *Submitted*.

**Alcorn, C., Velizhanin, K., Strzelercki, A., Migdisov, A., Nisbet, H., Currier, R., and Roback, R.**, “An Experimental Study of the Solubility of Rare Earth Chloride Salts (La, Nd, Er) in HCl Bearing Water Vapor up to 425 °C”, *In Press*.

Velizhanin, K., **Alcorn, C.**, Migdisov, A., Currier, R., “Rigorous Analysis of Non-Ideal Solubility of Sodium and Copper Chlorides in Water Vapor using Pitzer-Pabalan Model”, *Fluid Phase Equil.* (2020), **522**, 112731 – 112750.

**Alcorn, C., Alexander, J., Cox, J., Tremaine, P.**, “Quantitative Determination of Uranyl Chloride Speciation and Formation Constants under Hydrothermal Conditions using Raman Spectroscopy”, *In Preparation*.

**Alcorn, C., Cox, J., Applegarth, L. M. S. G. A., Tremaine, P. R.**, “Quantitative Determination of Speciation and Experimental Observations of Phase Separated Mixtures of Uranyl Sulfate and Sulfuric Acid Solutions under Hydrothermal Conditions”, *In Preparation*.

**Alcorn, C., Cox, J., Applegarth, L.M.S.G.A., Tremaine, P.**, “Quantitative Raman and Density Functional Theory Investigation of Uranyl Sulfate Complexation under Hydrothermal Conditions”, *J. Phys. Chem. B* (2019), **123**, 34, 7385 – 7409.

Applegarth, L.M.S.G.A., **Alcorn, C.**, Bissonette, K., Noël, J., Tremaine, P., “Non-Complexing Anions for Quantitative Speciation Studies using Raman Spectroscopy in Fused Silica High-Pressure Optical Cells under Hydrothermal Conditions”, *J. Appl. Spectrosc.* (2015), **69**, 972 – 983.

**Alcorn, C., Brodovitch, J.-C., Percival, P., Smith, M., Ghandi, K.**, “Kinetics of the Reaction Between H· and Superheated Water Probed with Muonium”, *Chem. Phys.* (2014), **435**, 29 – 39.

Cormier, P., **Alcorn, C.**, Legate, G., Ghandi, K., “Muon Radiolysis Affected by Density Inhomogeneity in Near-Critical Fluids”, *Radiat.Res.* (2014), **181**, 396 – 406.

## SELECTED CONFERENCE PRESENTATIONS AND TALKS

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**Alcorn, C. et al.**, "An Overview of Hydrothermal Chemistry at Los Alamos National Laboratory", IAWPS PCAS Symposium (2021).

**Alcorn, C. et al.**, "Solubility Measurements of Rare Earth Chlorides in Low Density HCl Bearing Water Vapour from 350 – 425 °C", Goldschmidt (2020), Honolulu, HI, USA.

**Alcorn, C.**, Cox, J., Applegarth, L. M. S. G. A., Tremaine, P. R., "In-Situ Determination of Individual Speciation Concentrations in Phase Separated UO<sub>2</sub>SO<sub>4</sub> Solutions Using Raman Spectroscopy", 74<sup>th</sup> Calorimetry Conference, (2019), Santa Fe, NM, USA.

**Alcorn, C.**, Cox, J., Applegarth, L., Tremaine, P., "Quantitative Raman Investigation of Uranyl Sulfate Complexation under Hydrothermal Conditions", *UNENE Student Workshop* (2016), Toronto, Canada.

**Alcorn, C.**, A., Brodovitch, J.-C., Ghandi, K., Percival, P., Satija, P., "Kinetics of the Reaction between H· and Hydroxide Ions in Supercritical Water Probed with Muonium", *Proc. 33<sup>rd</sup> CNS Conf.* (2012), Saskatoon, Canada.

**Alcorn, C.**, Cuperlovic-Culf, M., Ghandi, K., "Comparison of the Computational NMR Chemical Shifts of Choline with Experimental Data", *Journal of Physics: Conference Series* (2012), **341**, 012013.

**Alcorn, C.**, Smith, M., Kennedy, A., Brodovitch, J.-C., Ghandi, K., Percival, P., "Kinetics of the Reaction of H· and Superheated Water Probed with Muonium", *Proc. ISSCWR-5* (2011), Vancouver, Canada.

Legate, G. **Alcorn, C.**, Brodovitch, J.-C., Ghandi, K., Percival, P., "Kinetics of the Reaction between Mu· and Ni<sup>2+</sup> in Superheated Water", *Proc. ISSCWR-5* (2011), Vancouver, Canada.

Ghandi, K., **Alcorn, C.**, Brodovitch, J.-C., Driedger, E., Mozafari, M., Percival, P., Satija, P. "Using Muonium to Probe the Kinetics of the Reaction Between the H· Atom and OH· in Superheated Water", *Proc. ISSCWR-5* (2011), Vancouver, Canada.

Cormier, P., **Alcorn, C.**, Ghandi, K., Legate, G., "Effects of Density Inhomogeneity in Near-Critical Fluids on Muonium Formation", *Proc. 32<sup>rd</sup> CNS Conf.* (2011), Niagara Falls, Canada.

## POSTERS

**Alcorn, C.**, Cox, J., Applegarth, L., Tremaine, P., "Quantitative Raman Investigation of Uranyl Sulfate Complexation under Hydrothermal Conditions", *Proc. 37<sup>rd</sup> CNS Conf.* (2017), Niagara Falls, Canada.

**\*\*Winner of Best Ph.D. Student Contribution.**

**Alcorn, C.**, Cox, J., Applegarth, L., Tremaine, P., "Raman Investigation of the Complexation and Speciation of Aqueous Uranyl Sulfate under Gen IV Supercritical Water-Cooled Reactor Coolant Conditions", *UNENE Student Workshop* (2015), Toronto, Canada.

Applegarth, L., **Alcorn, C.**, Noël, J., Bissonette, K., Tremaine, P., "Non-Complexing Anions for Coolant Chemistry Studies by Raman Spectroscopy under Reactor Operating Conditions", *UNENE Student Workshop* (2013), Toronto, Canada.

**Alcorn, C.**, Cox, J., Applegarth, L., Tremaine, P., "Complexation and L-L Phase Separation of Uranyl Salts by Raman Spectroscopy", *UNENE Student Workshop* (2012), Toronto, Canada.