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Dept. of Chemical and Petroleum Engineering, University of Calgary, Calgary, AB T2N 1N4

[E-mail](#) | [Research Website](#)

EDUCATION

University of Calgary <i>Ph.D. Candidate in Chemical Engineering</i>	Sep. 2019 – Sep. 2024 (ABD) Calgary, Canada
University of Regina <i>M.A.Sc. in Petroleum Systems Engineering</i>	Sep. 2015 – Apr. 2019 Regina, Canada
Southwest Petroleum University <i>B.Eng. in Petroleum Engineering</i>	Sep. 2010 – Jul. 2014 Chengdu, China

RESEARCH INTERESTS

Microfluidics, Soft matter & Chemical physics

Kinetics and diffusion processes, Microscale thermophoresis, Capillary electrophoresis & Point-of-care diagnostics

REFERENCES

Dr. Anne M. Benneker

Associate Professor, Dept. of Chemical and Petroleum Engineering
University of Calgary
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Dr. Giovanniantonio Natale

Associate Professor, Dept. of Chemical and Petroleum Engineering
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PUBLICATIONS

Journal papers:

5. **Pu, D.**; Panahi, A.; Natale, G.; Benneker, A.M. Colloid Thermophoresis in Surfactant Solutions: Probing Colloid-Solvent Interactions Through Microscale Experiments. *J. Chem. Phys.* **2024**, 161(10), 104701.
4. Panahi, A.; **Pu, D.**; Natale, G.; Benneker, A.M. Polymer Concentration Regimes from Fractional Microrheology. Major revisions at *The Journal of Rheology*, **2024**. Arxiv preprint: [10.48550/arXiv.2403.10130](https://arxiv.org/abs/10.48550/arXiv.2403.10130)
3. John, J.; Panahi, A.; **Pu, D.**; Natale, G. Progress in Rheology of Active Colloidal Systems. Submitted to *Current Opinion in Colloid & Interface Science*, **2024**.
2. **Pu, D.**; Panahi, A.; Natale, G.; Benneker, A.M. A Mode-Coupling Model of Colloid Thermophoresis in Aqueous Systems: Temperature and Size Dependencies of the Soret Coefficient. *Nano Letters*, **2024**, 24(9), 2798-2804.
1. **Pu, D.**; Panahi, A.; Natale, G.; Benneker, A.M. Colloid Thermophoresis in the Dilute Electrolyte Concentration Regime: From Theory to Experiment. *Soft Matter*, **2023**, 19(19), 3464-3474.

Patents:

1. **Pu, D.** High-pressure Sapphire Cell For Real-time Visualization of Foamy Oil Flow. Chinese Patent Application No. 02123338073.6. **2022**.

RESEARCH EXPERIENCE

Graduate Student Researcher Sep. 2019 – Present

MicroTransport Lab & Complex Fluids Laboratory, University of Calgary

- Developed a thermofluidic platform with femto-Newton sensitivity for quantifying chemical interactions at the molecular level.
- Multiscale modeling of bulk and interfacial interactions at solid/liquid interfaces to understand the origins of temperature and size dependencies of molecular interactions in aqueous systems.
- Mechanistic study of colloid thermophoresis in surfactant solutions to quantify the role of temperature and surface chemistry on electrostatic, steric, and hydration interactions at silica/water interfaces using capillary electrophoresis-thermophoresis (CET).
- Microfluidic studies on the thermocapillary migration of surfactant-laden droplets to understand the temperature and curvature dependencies of interfacial tension at the microscale.

Graduate Student Researcher Sep. 2015 – Apr. 2019

Faculty of Engineering & Applied Science, University of Regina

- Developed a chip-scale platform for *in situ* structure & physicochemical characterization of gas-in-oil dispersions under high-pressure conditions.
- Mechanistic study of nonequilibrium phase behavior in CH₄/CO₂/heavy oil systems & its relevance to bubble nucleation, growth and coalescence.

Undergraduate Student Researcher Sep. 2010 – Jul. 2014

School of Oil & Nature Gas Engineering, Southwest Petroleum University

- Application of the material balance model for shale gas reserve estimation.

SCHOOLS, WORKSHOPS & CONFERENCES

Stat & QuantPhys Winter School on "Statistical Physics and Quantum Physics" Feb. 2024

Analytical Quantum Complexity RIKEN Hakubi Research Team & Hatano Laboratory

A Mode-Coupling Model of Colloid Thermophoresis in Aqueous Media: Oct. 2023

Probing the Interactions in Many-body Systems

Canadian Chemical Engineering Conference

Theory and Experiment on Colloid Thermophoresis in Aqueous Media Oct. 2022

Using Lab-on-a-chip Platforms

Canadian Chemical Engineering Conference

Certificate Workshop on "Regulators, Valve Selection & Tube Fitting Installation" Jul. 2017 – Nov. 2017

Swagelok Central Canada

TEACHING & VOLUNTEERING EXPERIENCE

Volunteering for the Canadian Chemical Engineering Conference Oct. 2023

Chemical Institute of Canada

Calgary, AB

Teaching Assistant of ENCH 403: Heat Transfer (Laboratory Tutoring/Supervising) Fall 2021

University of Calgary

Calgary, AB

AWARDS, GRANTS & HONOURS

Canada First Research Excellence Fund (CFREF) Program Sep. 2019 – Dec. 2023

The Graduate Excellence Award Winter 2024

The Graduate Excellence Award Fall 2020

Line Faculty Scholarship Fund Award Fall 2017

Faculty of Graduate Studies and Research Graduate Scholarship Fall 2017

OTHER ACTIVITIES

Reviewer of Journal of Chemical Engineering Science	2024 – Present
Designed and implemented training protocols for laboratory employees on experimental techniques, image tracking and analysis, and laboratory safety procedures	2023 – Present
Fabrication of bicontinuous interfacially jammed emulsion gels (BIJELS)	2023 – 2024

SKILLS

CAD and fabrication: AutoCAD, Soft lithography & Surface modification

Microfluidics: Microfluidic droplet generation system, Microfluidic flow & temperature control

Physicochemical characterization: Bright-field microscopy, Fluorescence intensity & fluorescence lifetime imaging, Dynamic light scattering, Scanning electron microscopy, FTIR, Capillary electrophoresis, Microscale thermophoresis, Pendant drop tensiometry, Benchtop density meter & Capillary/rotational viscometer

Computing software: Python, MATLAB, COMSOL Multiphysics & Fiji Image J

Theoretical skills: Nonequilibrium statistical physics, Low-Reynolds number hydrodynamics & Surface thermodynamics