Dr. Ramón Castañeda-Priego
NIST Center for Neutron Research and
Universidad de Guanajuato, Mexico

Dr. Castañeda-Priego is Professor of Physics, Sciences and
Engineering Division at the University of Guanajuato and a
Visiting Professor at the National Institute of Standards and
Technology (NIST). He received a Bachelor of Science (B.Sc.)
in Physics from the Universidad Veracruzana and a Ph.D. in
Physics from Cinvestav, the Center for Research and Advanced
Studies of the National Polytechnic Institute of Mexico. He
held a postdoctoral position at the University of Konstanz and
was a Visiting Professor at the University of Delaware. His
research interests and specialties include statistical mechanics
of simple and complex fluids, computational physics,
mathematical modeling, integral-differential equations, and
computer modeling. He has multiple publications and has
received several honors and awards, including the Award of
the Mexican Academy of Sciences for Young Scientists.

“Effective Interactions Between Macromolecules Close to a
Thermodynamic Instability and the Boundary of Gelation”

Effective interactions between macromolecules at the mesoscopic scale are typically
measured or calculated under equilibrium conditions and when the host medium is far
away from any kind of thermodynamic transition. However, it has been recently pointed
out the importance of the thermodynamic state on the determination of effective
potentials between colloidal particles. For example, like the Casimir forces between two
uncharged conductive plates mediated by the vacuum fluctuations, the so-called critical
Casimir forces between two mesoscopic objects (colloidal particles) emerge when the
solvent experiences a gas-liquid phase separation; in such a thermodynamic state the
spatial correlation length between solvent particles diverges leading to strong density
fluctuations that are the responsible for the appearance of attractive forces between
the colloids. In this talk, I will present a theoretical framework based on the integral
equations theory for liquids that accounts for the effective forces among colloids even
under situations where the system is close to a thermodynamic instability or near to the
boundary of gelation, i.e., a non-equilibrium state of matter. We particularly discuss a
few examples, namely, binary mixtures of hard-spheres close to the so-called demixing
transition and colloids immersed in a dispersion of soft particles that experience either
a fluid-solid transition or a gel transition. Our theoretical results are explicitly compared
with computer simulations and available experimental data.