

Rohit Bhartia, Ph.D

Jet Propulsion Laboratory

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RELEVANT EXPERIENCE:

For the last 16 years, Rohit Bhartia has been leading research and instrument development programs for deep UV based native fluorescence/Raman instruments for JPL under NASA (Astrobiology, organics, and life detection), NSF (life detection in extreme environments), and DoD (chemical/biological/explosives) programs. Under this program he has led a multi-institution team in developing the science and the instrumentation for to enable organic and life detection analysis for planetary science and terrestrial applications. This has led to the first hyperspectral deep UV native fluorescence/Raman imaging for differentiating and characterizing organics and/or microbes on natural surfaces and is the Deputy-PI on the selected Mars 2020 flight instrument (SHERLOC). He has also led instrument deployments to extreme environments such as Antarctica, the Arctic, Death Valley, and the deep ocean subsurface. His work has also led to data analysis methods that focus on using the technology for life detection by fusion of deep UV native fluorescence and deep UV Raman spectroscopy. His current efforts focus on spatially correlated organic chemistry with mineralogy analysis using a combination of native fluorescence and Raman spectroscopy to understand the distribution of organics/microbes to deduce their provenance or mechanism of survival. This research focus extends from planetary science with life detection and the origin of organics to detection and characterization of extreme life on earth and development of tools for water quality analysis or biological/chemical threat detection.

EDUCATION:

Ph.D	University of Southern California	2011	Geological Sciences/Geobio
	Thesis: <i>Non Invasive Detection of Microbes in Natural Environment Using Deep UV Native Fluorescence Spectroscopy and Hyperspectral Imaging.</i>		
M.S	University of Southern California	2009	Biomedical Engineering
B.S	University of Wisconsin – Madison	1998	Bacteriology

CURRENT/PREVIOUS POSITIONS:

2014 - Present	Deputy PI- SHERLOC – Deep UV fluorescence Raman Instrument (Mars 2020)
2007 – Present	Deep UV Raman/Fluorescence Instrument & Science Lead Astrobiology & Planetary Chemistry Group, Jet Propulsion Laboratory
1998 – 2007	Technical Staff, Deep UV Raman/Fluorescence Instrument Lead, Astrobiology Group, Jet Propulsion Laboratory

RESEARCH AND FIELD INSTRUMENT EXPERIENCE

2013	Deputy PI, Mars 2020, SHERLOC – Deep UV Instrument
2013 – Pres.	Co-I/JPL PI, Life Underground, NASA/NAI
2011 – Pres.	PI, Mineralogical/organic analysis instr. (GURILA) NASA/ASTID
2012 –2013	PI, Anthropogenic Influences on Microbial Ecology, JPL/DRDF
2009 – Pres.	Co-I/JPL PI, Fluorescence/Raman Data Fusion, Army
2011 – 2012	Co-I/JPL PI, Deep UV Microscopy, Army Research Office
2009 – 2013.	Co-I, Naphthalene Optical Dosimeter, Army Research Office
2009 – Pres.	Co-I, Investigation Lead: Path to Flight, Icy Worlds, NASA/NAI
2010 – 2011	Instrument Lead/ JPL PI for DEBI-t development
2010 – 2011	PI, Deep UV Mars Instrument Development Program, JPL/Strategic Init.
2007 –2011	Co-I/JPL PI, Robotic & hand held deep UV Standoff Instrument, DTRA
2009- 2012	Co-I/JPL PI, Direct Detection of Contamination on Spacecraft, NASA/PPR
2006-2007	DUV Fluor/Raman instrument lead: Svalbard, Norway, NASA/ASTEP
2003-2007	Lead for DUV instruments deployed in Antarctica, Death Valley, and Arctic, NASA/ASTEP
2004	DUV instrument software lead for Pacific Hydrothermal Vent Expedition

AWARDS/NTRS

JPL Outstanding Accomplishment Award – Astrobiology 2000, 2003

JPL Team Award – Deep UV Hydrothermal Vents Expedition – 2004

JPL Outstanding Accomplishment Award- Deep UV instrument Development with Cliffbot rover– 2007

JPL Mariner Award – Adv of JPL Deep UV Raman/Fluorescence Technology - 2009

New Technology Report Award – “Quantum Dots for on-off biological labeling -2002

New Technology Award- “UV sources for detection of Improvised Explosive Devices” – 2008

PUBLICATIONS (corresponding *) :

- **Bhartia, R.***, W.H. Hug, R.Reid, L. Beegle, (2015) Explosives Detection and Analysis by Fusing Deep UV Native Fluorescence and Resonance Raman Spectroscopy. P.M. Pellegrino, E.L. Holthoff, M.E. Ferrell (Eds.) *Laser-based Optical Detection methods of Explosives*, Boca Raton, FL: Taylor & Francis Group.
- Steele A., F.M. McCubbin, L.G., Benning, S. Siljestrom, G.D. Cody, Y. Goreva, E.H. Hauri, J. Wang, A.L.D Kilcoyne, M. Grady, A. Verchovsky, H. Sabbah, C. Smith, C. Freissinet, P.D Glavin, A.S. Burton, M.D Fries, J.D. Rodriguez Blanco, M. Glamoclija, K.L. Rogers, S. Mikhail, R.N. Zare, Q.Wu, A. Ismail, J.P. Dworkin, **R. Bhartia**, “Organic Carbon Inventory of the Tissint Meteorite – Evidence of Hydrothermal Organic Synthesis in a Martian Basalt” *in review – Nature*.
- Salas, E.C., **R. Bhartia**., W.Hug, R.Reid, G. Turrino, K. Edwards, “Detecting the deep biosphere in igneous ocean crust” (*ISME*) – *in prep*
- Abbey, W., L. Beegle, K. Williford, A. Burton, V. Paez, K. Sijapati, S. Sijapati, **R. Bhartia*** “Deep UV Raman Spectroscopy for Planetary Exploration: The Search for *in situ* Organics”, *Icarus*, *in prep* (Oct 2014)
- Beegle, L.W., **R. Bhartia***, L. DeFlores, M. Darrach, R. D. Kidd, W. Abbey, S. Asher, et al. “SHERLOC: Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals, an Investigation for 2020.” *Lunar and Planetary Institute Science Conference Abstracts* 45 (March 1, 2014): 2835.
- Russell, M.J., L.M. Barge, **R. Bhartia**, D. Bocanegra, P.J. Bracher, E. Branscomb, R. Kidd, S. McGlynn, D.H. Meier, W. Nitschke, T. Shibuya, S. Vance, L. White, I. Kanik. “The Drive to Life on Wet and Icy Worlds” *Astrobiology* 14, no. 4 (2014): 1-36.
- White, LM, **R. Bhartia**, GD Stucky, I. Kanik, MJ Russell. “Characterizing Composition Variations in Catalytic Iron-Sulfide Species in Ancient Alkaline Hydrothermal Vent Systems” *reviewed by EPSL – in revision*.
- Abbey, W.J., E. Salas, **R. Bhartia**, L.W. Beegle. “The Mojave Vadose Zone: a Subsurface Biosphere Analogue for Mars.” *Astrobiology* 13, no. 7 (July 2013): 637–646.
- **Bhartia R.***, M. D. Fries, W. H. Hug, R. D. Reid, L.W. Beegle, A. Alwood, A.L. Lane, E. C. Salas, K. H. Nealson “ Deep UV Native Fluorescence and Resonance Raman Imaging Spectroscopy for In-situ Organic Detection”, *Lunar Plan. Sci.* 41 , 2674. (2010)
- **Bhartia, R*.**, E.C. Salas, W. Hug, R. Reid, A.L. Lane, K.J. Edwards., K.H. Nealson 2010. “Label-Free Bacterial Imaging with Deep-UV-Laser-Induced Native Fluorescence.” 76(21): *Applied Environmental Microbiology*, 7321–7237.
- Beegle, L.W., Peters, G.H., Anderson, R.C., **Bhartia, R.**, Ball, A.G., Sollitt, L., Particle Sieving and Sorting Under Simulated Martian Conditions, *Icarus* (2009), doi: 10.1016/j.icarus.2009.07.008
- **Bhartia, R*.**, W.Hug, E.C.Salas, R.Reid, K. Sijapati, A. Tsapin, W.J. Abbey, P.G. Conrad, K. Nealson, and A.L.Lane, “Classification of Organic and Biological materials with Deep UV Excitation”. *Applied Spectroscopy*, Vol. 62 (10), October 2008.