CFEL SCIENCE

SEMINAR

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CFEL – Building 99, seminar room IV (first floor)

Timothy C. Steimle

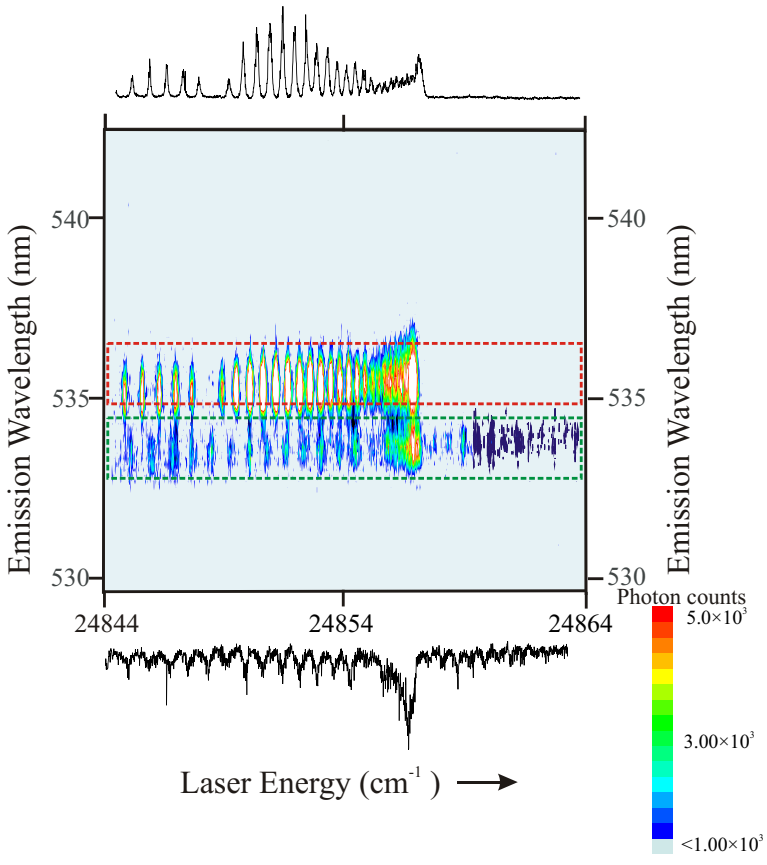
School of Molecular Sciences, Arizona State University, Tempe, AZ 85287, USA

Optical Stark and Zeeman studies of heavy metal containing molecules

One area of interest in our group is the characterization of gas-phase heavy metal-containing molecules relevant to searches for new physics beyond the standard model[1,2]. These measurements have traditionally focused on the eEDM determination using the a $^3\Delta_i$ state of ThO or $X^2\Sigma^+$ state of YbF. Recently, another T,P-odd interaction, namely the nuclear magnetic quadrupole moment (MQM) interaction with electrons, using the a $^3\Delta_i$ state of TaN has been proposed[3]. A second area interest in our lab is the characterization and interpretation of gas-phase gold containing molecular spectra (e.g. AuS, AuO, AuCl, Au_2) to glean insight into the role of relativistic contributions. The gold-X (X=S,O, halides) bond is a key component to numerous established and emerging technologies and these simple systems are amenable to both high-resolution spectroscopy and high level computational methodologies.

A brief description of our spectroscopic methods will be given, followed by examples from recent ongoing studies of ThO[4], TaN, and AuS[5]. A two dimensional technique will be highlighted because it is facilitating the detection of small polyatomic species (e.g. SiHD and SiO_3). The determined properties include electronic state energies, bond lengths and angles, vibrational frequencies, permanent electric dipole moments, μ_{el}, magnetic dipole moments, μ_m, hyperfine interactions, florescence branching ratios, and radiative lifetimes.

References:1) J.J. Hudson *et al.* Nature 2011; 2) Baron *et al.* Science (2014); 3) Skripnikov *et al.* PRA(2015); 4)Kokkin et al. PRA (2015); 5) Kokkin *et al.* JPCA(2015).



Host: Terry Mullins / CFEL Molecular Physics Seminar