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Nissim Kanekar obtained his B.Sc. from Mumbai University in 1993, his M.Sc. from Pune University in 1995, and his Ph.D. from Pune University in 2000. After a NOVA Fellowship at the Kapteyn Institut, Groningen, The Netherlands, and a Jansky Fellowship and a Max-Planck Fellowship, both at the National Radio Astronomy Observatory, Socorro, USA, he joined the National Centre for Radio Astrophysics in September 2009 as a Reader and a Ramanujan Fellow.

RESEARCH DESCRIPTION

My research is in two broad areas: (1) using astronomical spectroscopy to probe changes in the fundamental constants of physics, and (2) using imaging and spectroscopic techniques to study galaxy evolution. Temporal evolution in the fundamental constants is a generic prediction of higher dimensional theories that attempt to unify the standard model of particle physics and general relativity. Astronomical studies allow one to test for such evolution over cosmological timescales. We have come up with a new theoretical method to probe fundamental constant evolution, using hydroxyl (OH) lines, and have applied this method to obtain tentative evidence (at 99.1% significance) for a change in either the fine structure constant α, the proton-electron mass ratio $\mu \equiv m_p/m_e$ or the proton g-factor g_p over the last 3 Gyrs. We have also obtained the strongest present constraint on changes in the proton-electron mass ratio, using inversion and rotational lines. I am currently attempting to test the above OH result, using significantly deeper spectra from the Arecibo telescope which should allow us to confirm or deny the present result at $>5\sigma$ significance. I am also applying other techniques, based on comparisons between different spectral lines, to significantly improve our sensitivity to changes in the different constants.

In galaxy evolution, my main work has involved HI-21cm absorption studies of high-redshift galaxies towards background quasars. We have shown that gas in these galaxies is predominantly warm, apparently due to their low metallicity and a paucity of cooling routes. I have also come up with a new method to image such galaxies, using a higher-redshift absorber as a "blocking filter" to entirely remove the background quasar, so that one can then image the lower redshift galaxy. We are currently carrying out imaging and spectroscopic studies of a large sample of such galaxies with the Keck Telescope and the Hubble Space Telescope, which should significantly improve our understanding of these systems.

SELECTED PUBLICATIONS

Kanekar, N., *Do the Fundamental Constants change with time ?* 2012, BASI, 40, 21.

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Kanekar, N., *Constraining Changes in the Proton-Electron Mass Ratio with Inversion and Rotational Lines* 2011, ApJ, 728, L12.

Kanekar, N., Chengalur, J.N., & Ghosh, T. *Probing Fundamental Constant Evolution with Redshifted Conjugate-satellite OH Lines*, 2010, ApJ, 716, L23

Kanekar, N., Prochaska, J. X, Ellison, S. L., & Chengalur, J. N. *Probing Fundamental Constant Evolution with Neutral Atomic Gas Lines*, 2010, ApJ, 712, L148

Fumagalli, M., O'Meara, J. M., Prochaska, J. X. & Kanekar, N. *Directly imaging damped Lyman-α galaxies at z > 2 - I. Methodology and first results*, 2010, MNRAS, 408, 362