

Understanding strong molecular hydrogen emission in astronomical environments

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(Submitted on 22 Jul 2011)

Here I describe recent studies of objects with molecular hydrogen emission that is strong relative to other spectral lines. Large telescopes and fast spectrometers have made the 2 μ m window accessible even for relatively faint objects. I summarize several environments where strong molecular hydrogen 2.121 micron emission is observed. The line is hard to excite due to its large excitation potential, and is most emissive in regions that have temperatures that are nearly high enough to dissociate molecular hydrogen. I outline several case studies. In the Helix planetary nebula strong emission is produced by rapidly flowing molecular gas that is exposed to an intense ionizing radiation field. This advective production of molecular hydrogen is a fundamentally non-equilibrium process. In the filaments surrounding brightest cluster galaxies in cool core clusters ionizing particles penetrate into magnetically confined molecular cores and excite the gas. Finally, I outline ongoing work on the Crab Nebula, where the first complete maps of molecular emission have only recently been completed. Both ionizing particles and high-energy photons may be important. Finally I speculate on the origin of the correlation between H₂ / H I intensity ratios and other properties found in Active Galaxies. This is suggestive of a hardening of the radiation field along the Eigenvector 1 sequence. In all of this work I take the approach of understanding H₂ emission along with emission from low and moderate ionization species, a necessary step if we are to really understand the context in which molecular hydrogen emission forms.

Comments: Narrow-Line Seyfert 1 Galaxies and Their Place in the Universe (NLS1 Milan, Italy)

Subjects: **Cosmology and Extragalactic Astrophysics (astro-ph.CO)**

Cite as: [arXiv:1107.4485](https://arxiv.org/abs/1107.4485) [astro-ph.CO]

(or [arXiv:1107.4485v1](https://arxiv.org/abs/1107.4485v1) [astro-ph.CO] for this version)

Submission history

From: Gary J. Ferland [[view email](#)]

[v1] Fri, 22 Jul 2011 11:33:23 GMT (2196kb)

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