Magnetized PDRs: M17 and the Orion Bar

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We have simulated the edge-on galactic PDRs of M17 and the Orion Bar, both in the vicinity of young stellar clusters. Combining X-ray, optical, infrared and radio observations we have constrained the transition from ionized to molecular gas. In the special case of the M17-SW PDR a direct measure of the magnetic field in the H^0 region is possible and reveals a peak field strength of ~600μG. Using the observed properties of the HII region to set the initial conditions, we created ab initio Cloudy models that begin at the illuminated face of the HII region and extend into the PDR. We modeled each phase of the ISM and each must be in simultaneous agreement with the observations. We explored various equations of state in M17 beyond constant density by including a magnetic field and found the gas is supported by the magnetic field which is responsible for the observed diffuse structure of the neutral gas. The low contrast of the density profile from the HII region through the PDR can be best explained as resulting from the compression of a frozen magnetic field by stellar radiation and wind pressure. In addition to the pressure in the PDR being magnetically dominated, there is evidence for extra heating from cosmic rays locally enhanced by the magnetic field.

We have applied the magnetic equation of state used in M17 to the well studied Orion Bar PDR. A similar magnetic field measurement like in M17 is not possible in the Bar. Instead we used the observed separation of stratification of the ionized neutral and molecular gas to estimate the importance of the magnetic field. Like in M17, the observed chemical stratification of the Bar is consistent with with an initially weak 8μG magnetic field amplified to 450μG in the PDR compensating for stellar radiation pressure. There is again evidence for an enhancement in the local cosmic ray heating rate over the galactic average and we consider the effects of the increased cosmic rays on the molecular chemistry. Ongoing are similar studies of NGC3603 and 30 Doradus with the aim of further developing models of distant Giant Extragalactic HII Regions.

For further details see paper I: *A Magnetically Supported Photodissociation Region in M17,* Pellegrini et al., 2007 ApJ 658, 1119