

**NIR Photometry and Optical/NIR  
Polarimetry  
Toward the RCW41 Star-Forming Region  
(2012 ApJ, 751, 138)**

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*Gemini North Adaptive Optics Workshop  
June 19-21, Victoria, Canada*



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Alexandre Roman-Lopes<sup>1</sup> Fábio Pereira Santos<sup>2</sup> Gabriel A. P. Franco<sup>2</sup>  
 1- Universidad de La Serena (La Serena, Chile) 2- Universidade Federal de Minas Gerais (Belo Horizonte, Brazil)  
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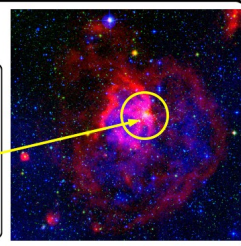
## The RCW41 Star-Forming Region:

- HII region located at 1.3kpc, in the **Vela Molecular Ridge** great molecular cloud (Roman-Lopes et al., 2009);
- Hosts a **massive stellar cluster** associated to the IRAS 09149-4743 source, which ionizes the surrounding ISM, mainly due to the action of two massive stars of O9v and B0v spectral types;
- Contains several YSO's (Ortiz, Roman-Lopes & Abraham., 2007).

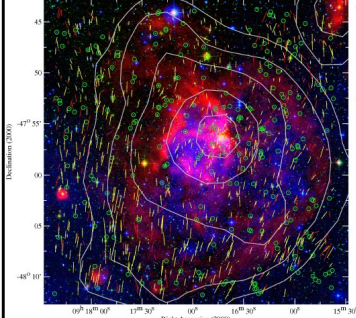
## Research Goals and Observational Data:

- **Optical/NIR Polarimetry** (VRI data from CTIO's 0.9m telescope – Cerro Tololo, Chile; H band data from OPD's 1.6m telescope – Pico dos Dias, Brazil): Study the **large-scale structure of the IS magnetic field lines** (with the optical data), and the **small-scale magnetic field lines** along the embedded stellar cluster (with the NIR data);
- **NIR Photometry** (JHKs, from the SofI Imager, ESO's NTT 3.6m telescope – La Silla, Chile): Study the **stellar population**, determine **cluster's age**, find YSO's.

Right: 30 × 30 arcmin RGB combination:  
 Blue: DSS R band (shows the ionized area);  
 Green: 2MASS Ks (shows the embedded cluster);  
 Red: MSX 8.2μm (shows the emission from hot dust surrounding the ionized area).

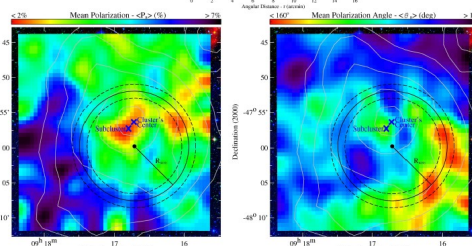
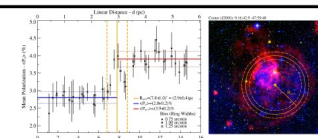


**Results from the Optical Polarimetry:** - Left: Large-scale polarization vectors map the sky-projected Galactic magnetic field lines;  
 RCW41: R band vectors, R/SDDS/Ks(2MASS/IR\_2μm/MSX) RGB image  
 P/ρ > 3    3 > P/ρ > 1    P/ρ < 1 & bad P values    P = 10%  
 IRAS 100μm contours, levels: 128, 170, 240, 500 and 1000 MJy/str



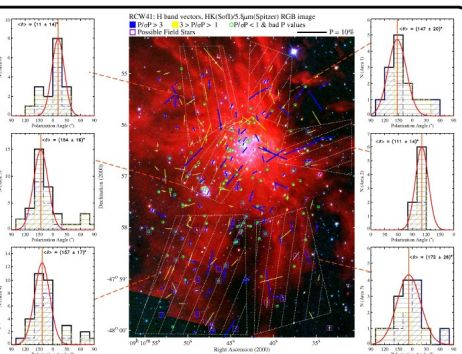
- Right, top: Defining increasing concentric rings inside the HII Region, an abrupt rise in P values is found over the "hot dust interstellar ring" seen in the MSX 8.2μm emission;

- Right, bottom: P and θ average maps. Low P values near the cluster suggest that IS dust has been swept away from inside the area. Abrupt changes in P and θ occur toward the mid-infrared ring: distortion of magnetic field lines.



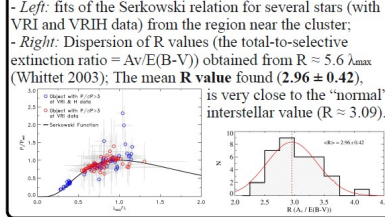
## Results from the NIR Polarimetry:

- Image: close-up view of the cluster area. Emission in Red: 5.8μm (Spitzer).  
 - White grids show the predominant pol. (H band) directions (from the histograms): on the cluster-size scale, magnetic field lines point inwards, although a large dispersion in θ values is observed.



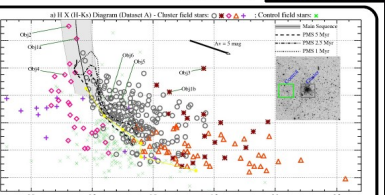
## Results from the Multi-Band Polarimetry:

- Left: fits of the Serkowski relation for several stars (with VRI and VRIH data) from the region near the cluster;  
 - Right: Dispersion of R values (the total-to-selective extinction ratio = Av/E(B-V) obtained from R ≈ 5.6 λ\_max (Whittet 2003); The mean R value found (2.96 ± 0.42), is very close to the "normal" interstellar value (R ≈ 3.09).



## Results from the NIR Photometry:

- Left: color-color diagram; Δ: color-excess stars, YSO candidates; Av = 7.6 ± 2.0;  
 - Right: color-mag diagram: main sequence and isochrones corrected by distance and reddening; from isochrones' positions, Mean Age = 2.5 – 5.0 Myr.



## Main Results and Conclusions:

- The low P values inside the HII Region suggest that dust particles have been swept away, destroyed or misaligned;
- On smaller scales (over the cluster), NIR P vectors point inwards, suggesting that magnetic field lines channeled IS material towards the cluster region, inducing star formation;
- The mean R value is 2.96 ± 0.42;
- Cluster's mean Age = 2.5 – 5.0 Myr;
- Several YSO candidates were identified.

## Acknowledgements:

The authors are grateful to CNPq (441307/2009-6) for the financial support. This research makes intensive use of the astronomical reduction package IRAF, specially the CCDPACK polarimetric reduction package, developed by Perera (2000).

## References:

- Roman-Lopes, A., Abraham, Z., Ortiz, R., & Rodriguez-Aranda, A. 2009, MNRAS, 394, 467.  
 - Ortiz, R., Roman-Lopes, A., & Abraham, Z. 2007, A&A, 461, 949.  
 - Perera, A. 2000, PhD Thesis, IAGUSP - Brazil.  
 - Whittet, D. C. B. 2003 - Dust in the galactic environment - 2nd ed. Institute of Physics



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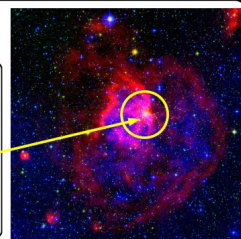
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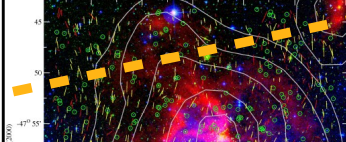
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