Polarized lines illuminate the progenitors of core-collapse supernovae J.L. Hoffman, S. DeSoto, C. Pickens, J. Churchill, L.N. Huk, D.C. Leonard, G.G. Williams, and the SNSPOL Project

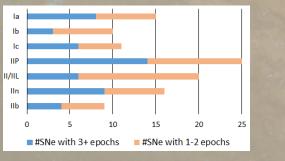
The SNSPOL Project

From 2010–2018, the SNSPOL Project created the largest existing database of polarized supernovae (SNe). Our team used the SPOL instrument (top) at the 61" Kuiper, 2.3-m Bok, and 6.5-m MMT (bottom) telescopes.

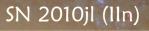




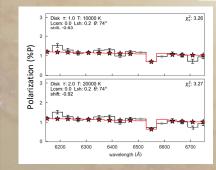
We observed 106 SNe of all types (below), 50 of these at 3+ epochs.



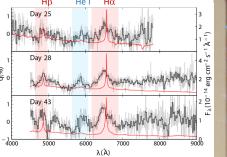
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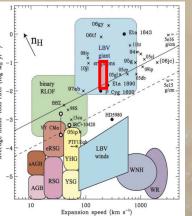
We have 11 epochs of SNSPOL data for SN 2010jl, which show strong H and He emission lines (right) whose profiles vary differently over time.



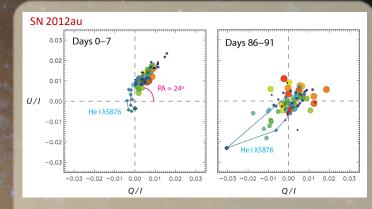
The CSM optical depth inferred from these models yields an estimate of the progenitor's massloss rate. We identify it as a luminous blue variable (right; Huk 2017; Smith 2017).



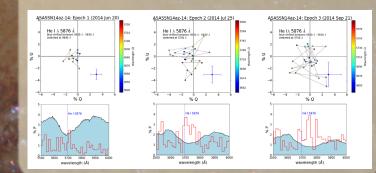
Monte Carlo modeling of the H α line profiles (left) constrains the shape, size, and density of the circumstellar scattering region.



SN 2012au (Ib) and ASASSN-14az (IIb)



In SN 2012au (above), the He I λ 5876 line diverges from the continuum at all epochs, suggesting a persistent equatorial structure. In ASASSN-14az (below), this line shows Q-U loops that imply a multi-axis geometry. With future modeling, we will re-examine the relationships among these SN types.



Awakenings

Two Gemini Polarization (GPOL) Units were built for Gemini North and South in 2003, but never commissioned. Our team was selected by AURA to investigate creating a single GPOL unit and commissioning it with the NIRI near-infrared imager.

1. Component shipping

GPOL-S (right) and parts of GPOL-N have been shipped to Herzberg Astrophysics (HAA) for inspection and testing. Renovation and Commissioning of the Gemini Polarization Module (GPOL) J.L. Hoffman, R. Diaz, D.L. DePoy, R. Cárdenes, E. Cook, J.R. Lomax, D. Monin, J. Pazder, G.A. Wade, J. White, J.P. Wisniewski

2. Mechanical testing

Team members at HAA have confirmed that all mechanical parts are in good condition and all motors operate smoothly.

> Herzberg Astrophysics

The single existing set of waveplates includes 3 different polarizers (right) and 2 half-wave retarders.

3. Software testing

Team members at Texas A&M and Gemini tested the software remotely with GPOL-N and verified repeatable plate rotation. We are working to migrate GPOL to the RTEMS operating system used by other Gemini controls.

4. Next steps

- Ship remaining GPOL-N components to HAA.
- Develop a renovation plan and tests for refurbished instrument and software.
- Design an observing strategy for GPOL with NIRI (below). Science commissioning projects include imaging protoplanetary disks and monitoring Be stars in open clusters.

