BISTRO – B-fields In STar-forming RegiOns

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<th>Yusuke Aso</th>
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BISTRO: Overview

- Aims to map Gould Belt star-forming regions in polarised light
- Awarded 224 hours of Band 2 observing time
- 106 survey members across 6 partner regions + EAO
- P.I.s: Derek Ward-Thompson (UK), Keping Qiu (China), Ray Furuya (Japan), Woojin Kwon (Korea), Shih-Ping Li (Taiwan), Pierre Bastien (Canada)
- DR team includes 3 members from each geographical region (meet monthly)
- We aim to map the high-column-density astronomical regions of:
  Ophiuchus, Orion A & B, Perseus, Serpens, Taurus L1495/B211, Auriga, IC5146 - all regions for which we have both SCUBA2 & HARP-B data
BISTRO: Scientific Goals

- To map the magnetic field within cores and filaments, on scales of ~1000-2000 AU
- To determine magnetic field strengths in nearby molecular clouds
- To investigate the relative importance of magnetic fields and turbulence to star formation
- To test the model of magnetic funnelling of material onto filaments
- To investigate the role of magnetic fields in shaping proto-stellar evolution
- To investigate the effect of magnetic fields on bipolar outflows from young proto-stars
BISTRO: The Plan

- There are 16 fields (16x14hrs = 224hrs)
- There are ~100 members / 16 fields ~ 6.25 members/field
- Japan, Korea & UK all have ~ 20 members each
- Canada, China & Taiwan all have ~ 12 members each
- EAO has 5 members
- Japan, Korea & UK lead 3 fields each
- Canada, China & Taiwan lead 2 fields each
- EAO to lead 1 field
BISTRO: Current Status

- Basic instrumental polarisation well-established:
  1.3%, parallel to elevation axis, at 850μm

- Details of instrumental polarisation model being investigated:
  Dependence on elevation & variation across the focal plane

- Revised flux conversion factors: ×1.35 at 850μm; ×1.96 at 450μm – achieving ~2mJy/beam in ~14 hours per field

- Tiling to map larger regions currently under investigation

- Observing has begun – 38% of programme observed

- Orion A, Oph A, B & C, Serpens Main complete

- IC5146, Auriga & Perseus begun

- Survey paper draft complete. First 2nd-generation paper drafted
POL-2: The Instrument

A single-beam imaging polarimeter

Measures linear polarisation (Stokes Q & U)

Half-wave plate (2Hz rotation)

Fixed analysers
Orion A seen by JCMT

Credit: Kate Pattle

POL-2: Performance

Credit: POL-2 Commissioning Team

RMS noise in Q & U maps (mJy/beam)

Integration time (minutes)

Credit: David Berry
Comparison with SCUBAPOL

Credit: Kate Pattle & POL2 Commissioning Team
Comparison with SCUBAPOL

Credit: Kate Pattle & POL-2 Commissioning Team
Orion A

Note the ‘double horse-shoe’ field morphology in the filament.

Is the field helical in the Orion Bar?

W-T et al., 2017 in prep.
Field orthogonal to filament

Image redacted

J Kwon et al
2017 in prep
Serpens Main

Vectors show field (blue $>3\sigma$, red $>2\sigma$)

Field perp to filaments

Percentage pol. reduces in high density regions

Image redacted

W Kwon et al., 2017 in prep

N2H+ CARMA image from Lee, Kwon et al., 2014
BISTRO papers in progress:

Ward-Thompson et al., in prep. - Survey paper & Orion A
Pattle et al., in prep. - C-F analysis of Orion A
J. Kwon et al., in prep. - First look at Oph A
Qiu et al., in prep. – First look at Oph C
Soam et al., in prep. - First look at Oph B
Tang et al., in prep. - First look at Serpens Main NW
W. Kwon et al., in prep. - First look at Serpens Main SE
Wang et al., in prep. - First look at IC5146
Coudé et al., in prep. - First look at Perseus B1
BISTRO: 2\textsuperscript{nd} generation

Proposed 2\textsuperscript{nd} generation papers:

- Magnetic field strengths*
- Models of magnetic field geometry
- Grain alignment
- Magnetically-regulated collapse
- Fields and filaments
- Fields and turbulence
- Fields and outflows
- Fields and core geometries

These papers will be written by the team

*First paper drafted – Pattle et al. 2017
Conclusions

• The story so far:
  • BISTRO has begun
  • 38% complete
  • Orion A, Oph & Serpens Main complete
  • 2\textsuperscript{nd}-generation papers started
  • Perseus & Auriga begun

• Ongoing work:
  • Data taking continues
  • Reduction software being upgraded