

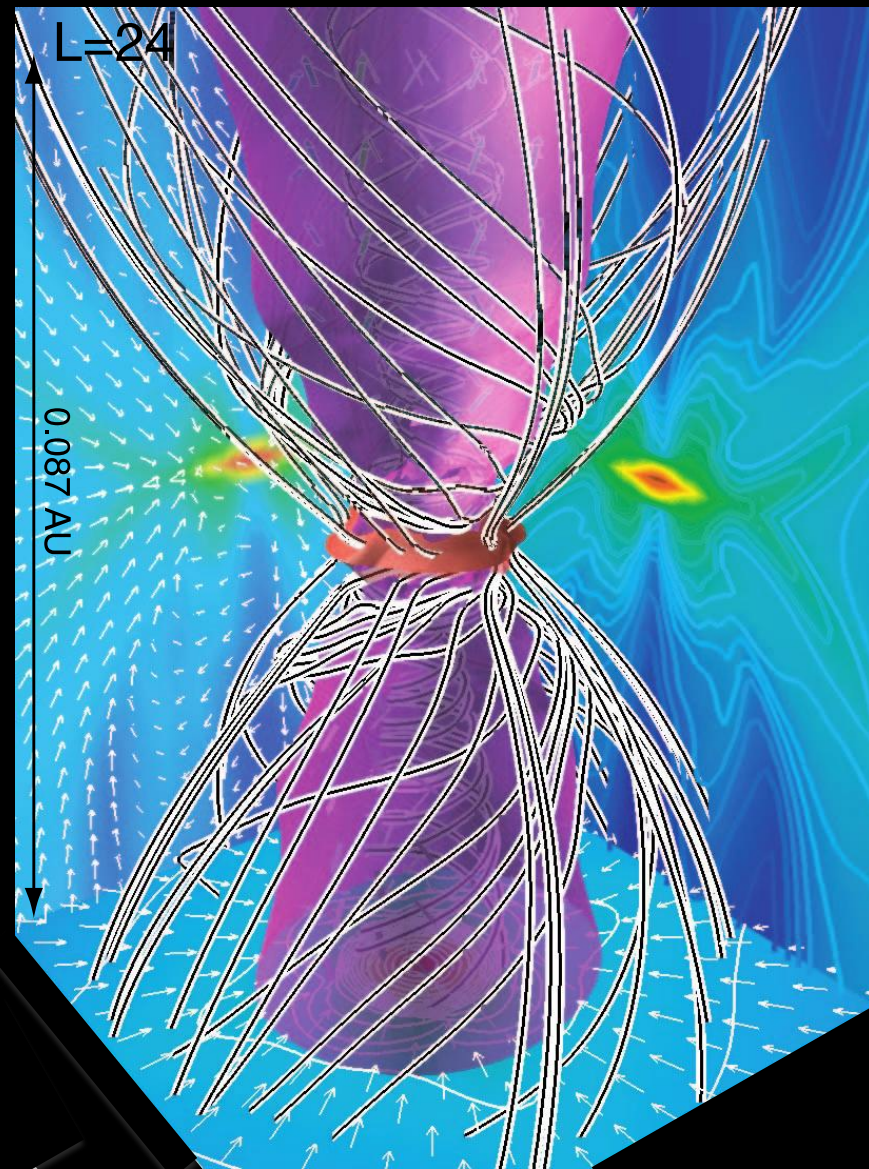
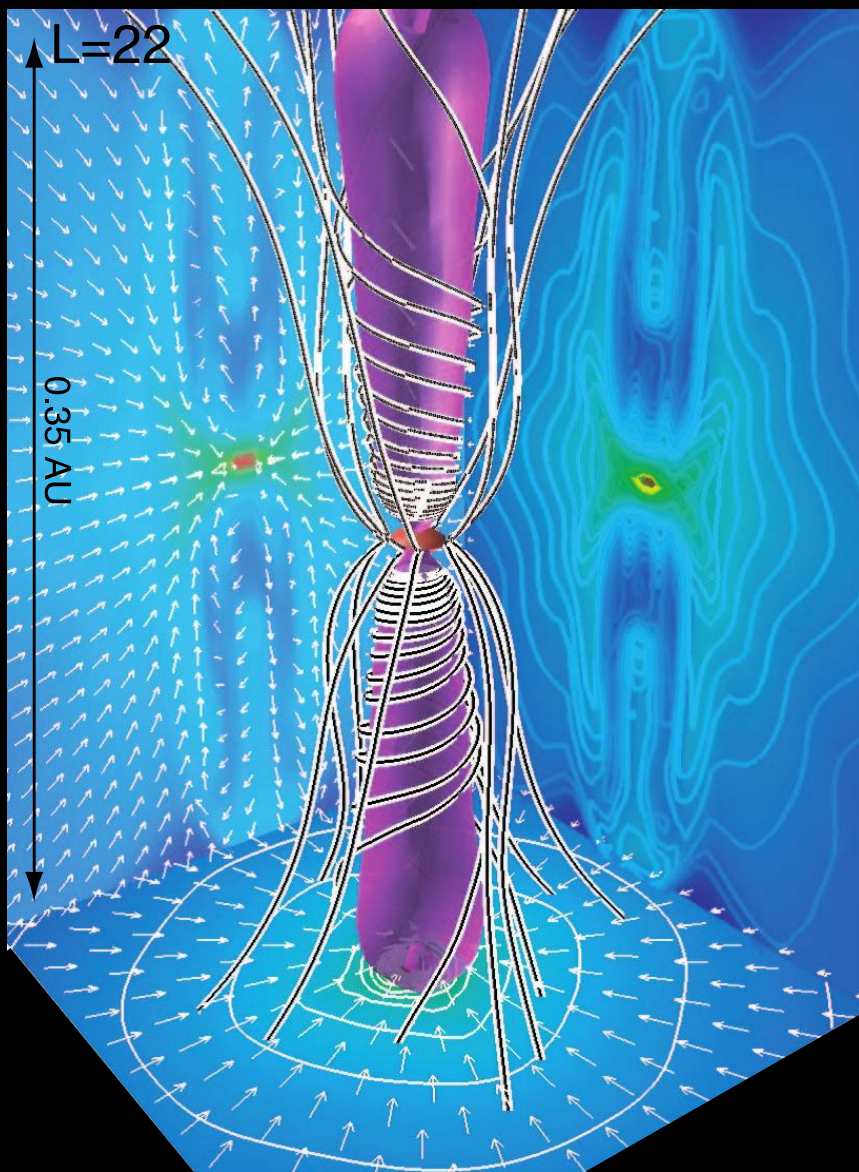
Simulating SMA dust polarization maps of magnetized protostellar cores

Ue-yu Pen (彭威禹)

National Central University

Supervisor: Shih-Ping Lai

National Tseng-Hua University



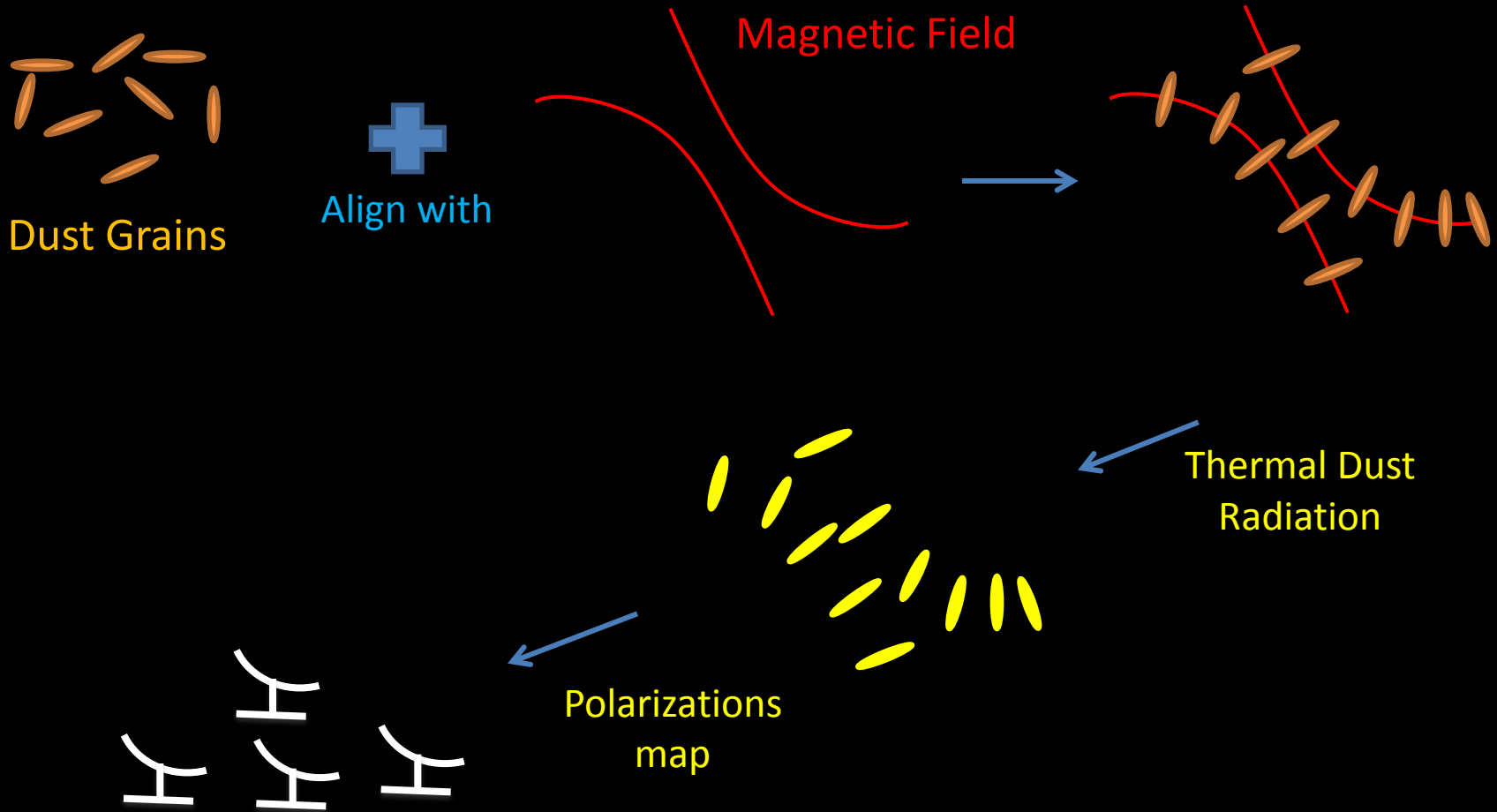
Machida *et al.* (2008)

As an observer, what can we see if those
models are real?

Introductions

How to observe the magnetic field?

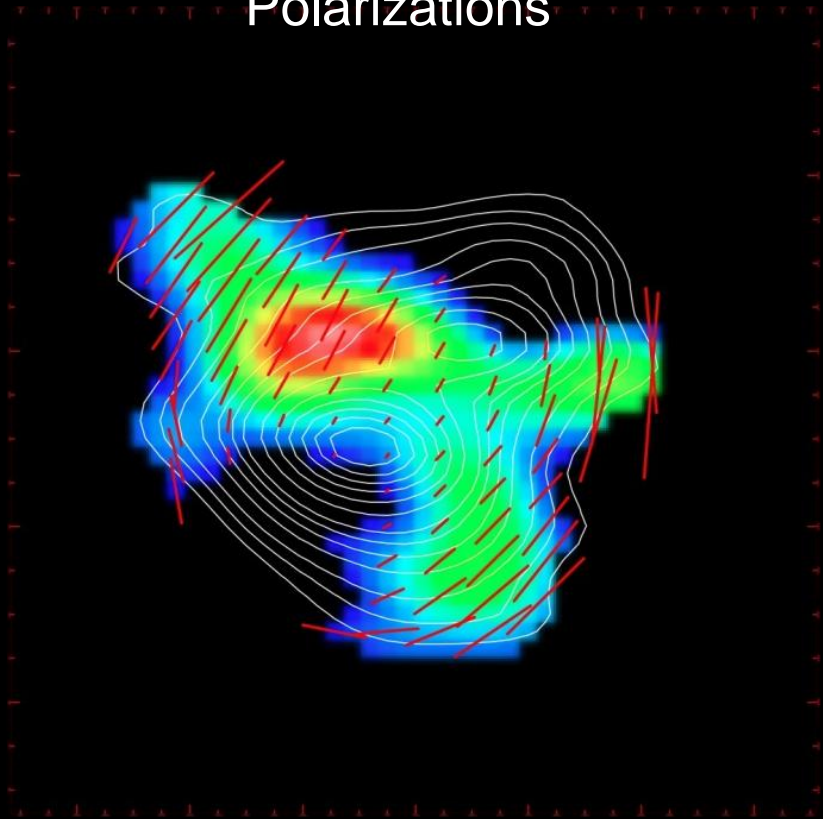
The distribution of the polarizations of thermal dust radiation gives information of the configuration of the magnetic field.



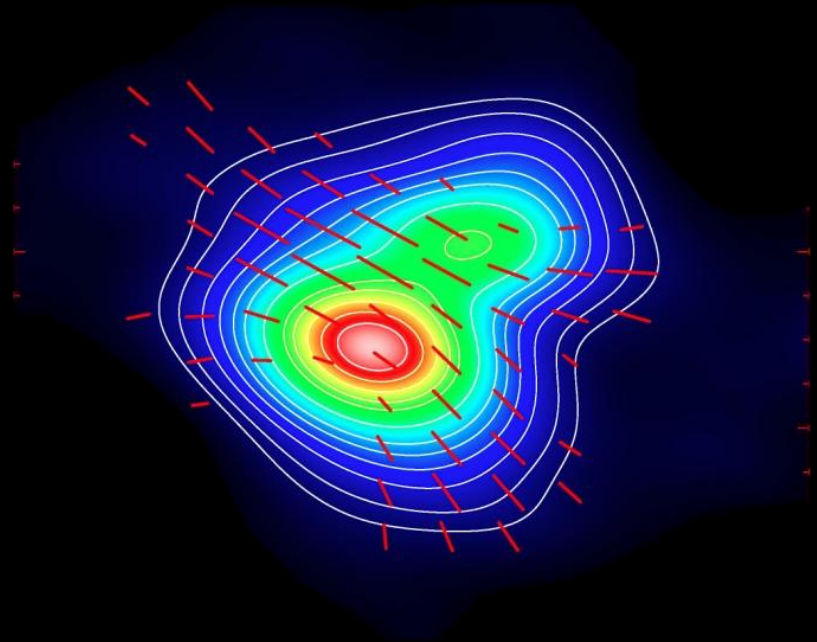
Polarizations map

Polarization of Dust Emission: $P \perp B_p$

Polarizations



B fields



Polarization map (left) and magnetic field map (right) from
Girart, Rao, & Marrone (2006), Science, 313, 812

As an observer, what can we see if those
models are real?

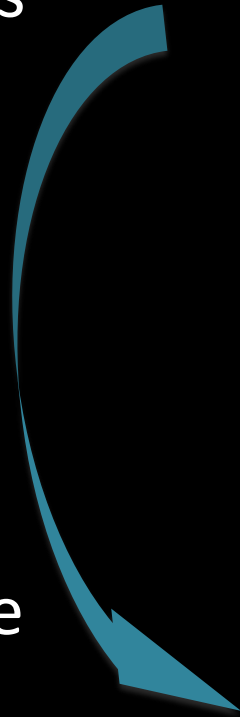
Our work

Some process

A target in
the sky

polarization
map from the
target

Observed SMA Map



Some theories

A model from
the theories

polarization
map from the
model

Simulated SMA Map

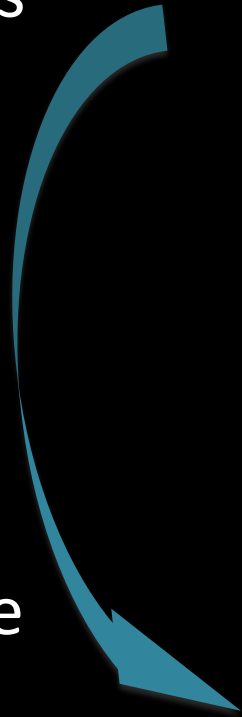


Some process

A target in
the sky

polarization
map from the
target

Observed SMA Map

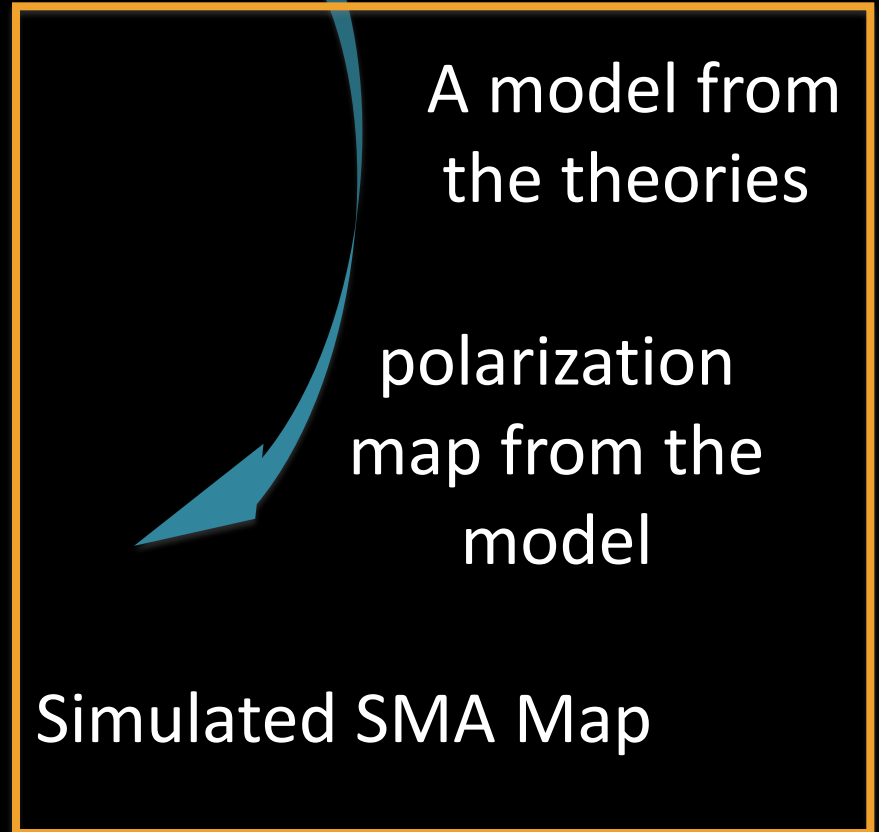
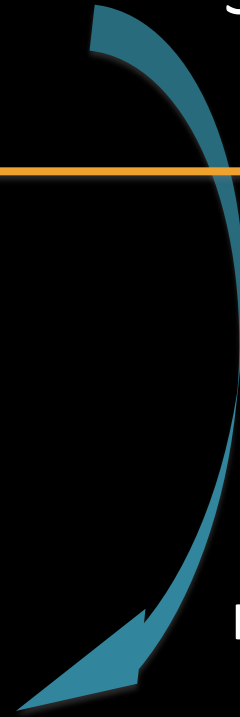


Some theories

A model from
the theories

polarization
map from the
model

Simulated SMA Map



Prof. Machida's group

Providing a model which was generated from some theories



A array that contains the profiles of the density and the magnetic field.

Our program

Integrating the 3D magnetic field profile into a 2D I, Q, U map



Stoke I,Q,U map

UVGEN in Miriad

Transferring the I,Q,U map into a SMA map

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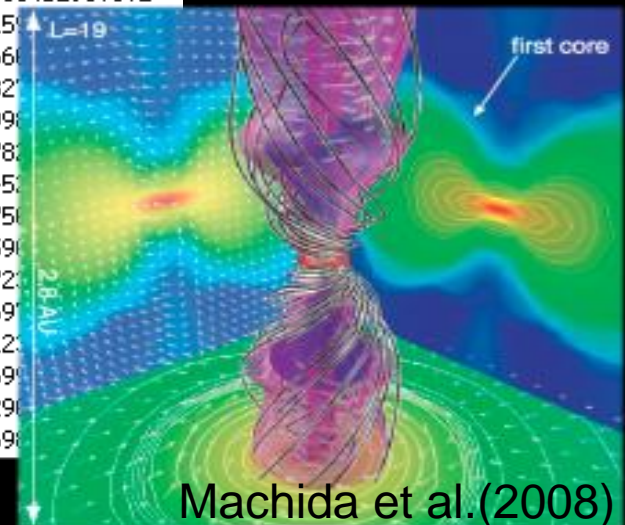
Transferring the I,Q,U map into a SMA map

Prof. Machida's group

Providing a model which was generated from some theories

$B_x(x,y,z)$ $B_y(x,y,z)$ $B_z(x,y,z)$ Density(x,y,z)

0.692934691905975	0.689030051231384	0.294819980859756	0.402524232864380
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0.685158491134644	0.788990318775177	0.347908765077591	0.430877089500427
0.680668175220490	0.817724883556366	0.362348973751068	0.437658339738846
0.674881517887115	0.847087323665619	0.376671463251114	0.443484395742416
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0.658795952796936	0.907336235046387	0.411561161279678	0.454939991235733
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0.102372184395790	1.32269942760468	0.756088316440582	0.531691111111111



Machida et al.(2008)

Prof. Machida's group

Providing a model which was generated from some theories



A array that contains the profiles of the density and the magnetic field.

0.652934691009775	0.689030851231304	0.294819080597756	0.482524232084308
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0.68515849113444	0.788990357755177	0.347903765977591	0.43807789569427
0.680868175228490	0.817724883555366	0.362348973751068	0.437658339738846
0.674881517871115	0.84708732655529	0.376671463251114	0.443484395742416
0.667932644691467	0.877845307677378	0.384847529477592	0.449462598865538
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Our program

Integrating the 3D magnetic field profile into a 2D I, Q, U map

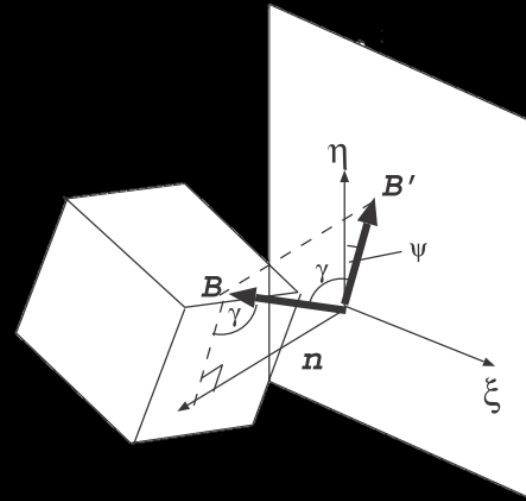
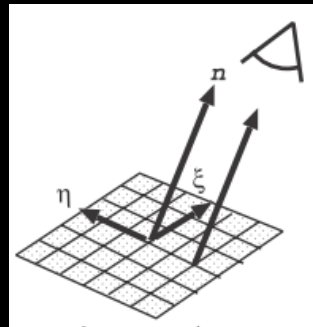
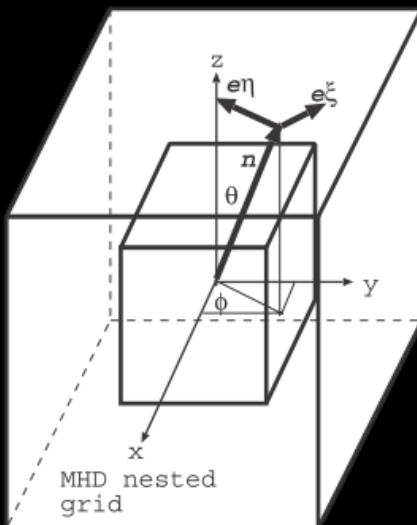
Stoke I,Q,U map

UVGEN in Miriad

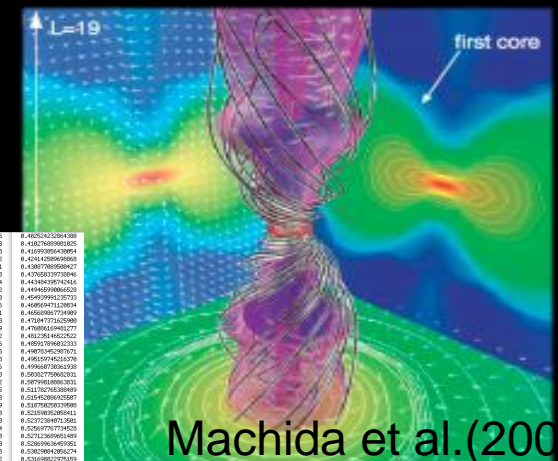
Transferring the I,Q,U map into a SMA map

Our program

Our program calculated the polarization distribution of thermal dust radiation using molecular outflow data obtained from two-dimensional axisymmetric MHD simulations.



Kohji TOMISAKA *et al.*



0.402764116075	0.40963081212304	0.254161508057156	0.40254212043303
0.4924761318171	0.71139713739139	0.38954616719248	0.4182788981825
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0.6886421281720	0.7617361294566	0.23438803535382	0.4244288988881
0.005299112464	0.7686868277577	0.247980758977551	0.438778898882
0.6886451282448	0.817274013555366	0.36249977751868	0.4702833733846
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0.6876965796106	0.97133212684387	0.41156111177978	0.4567099127373
0.44845391277213	0.9747944148898	0.43861488777446	0.4695847112824
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0.1821648170119	1.32394779688	0.7688131448882	0.6338182175181

Machida et al.(200

Our program

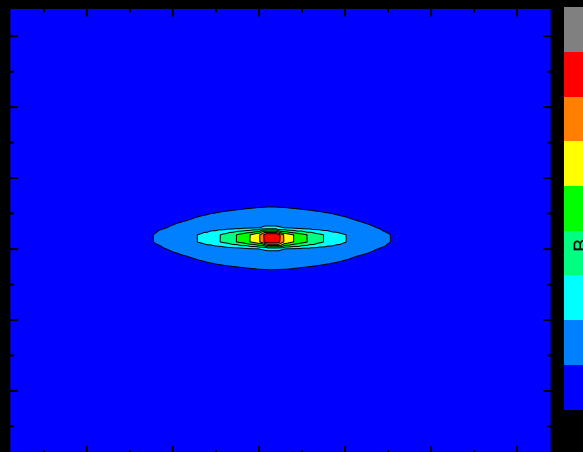
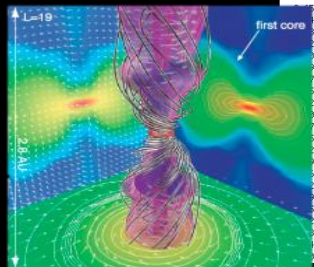
Integrating the 3D magnetic field profile into a 2D I, Q, U map

Bx(x,y,z) By(x,y,z) Bz(x,y,z) Density(x,y,z)

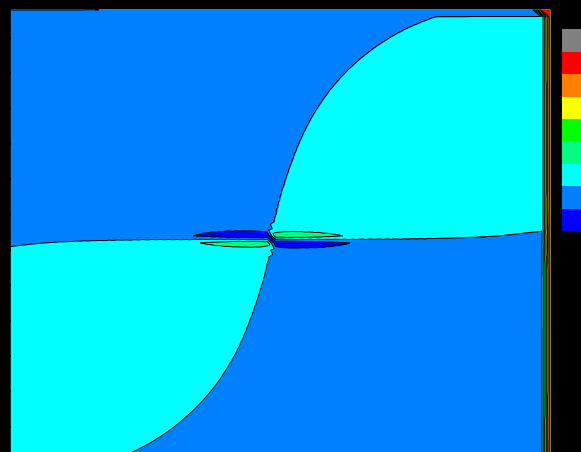
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0.6795952796936	0.907336235946387	0.411551161279676	0.454939991235733
0.6453991277313	0.937439441689888	0.438818488727646	0.468569471123834
0.6448217494965	0.967195928896771	0.448442161083221	0.465659867734989
0.6795952796936	0.996568156345367	0.468598786586838	0.471847371625900
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0.6795952796936	1.26832163333893	0.689132638025843	0.52159032088411
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0.6795952796936	1.30488933189392	0.725473781953888	0.527123689651489
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$$q = \int \rho \cos 2\psi \cos^2 \gamma ds ,$$

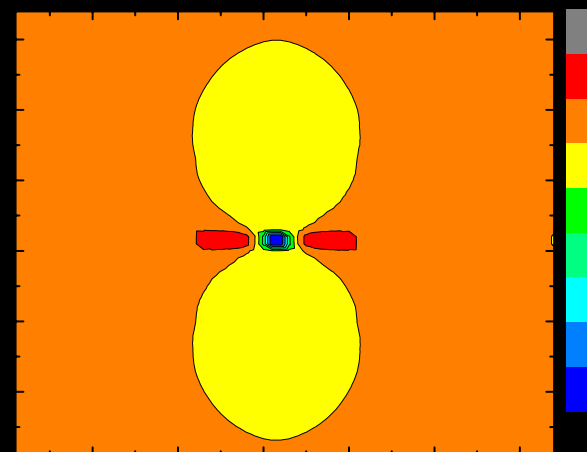
$$u = \int \rho \sin 2\psi \cos^2 \gamma ds .$$



Stokes I map



Stokes U map



Stokes Q map

Prof. Machida's group

Providing a model which was generated from some theories



A array that contains the profiles of the density and the magnetic field.

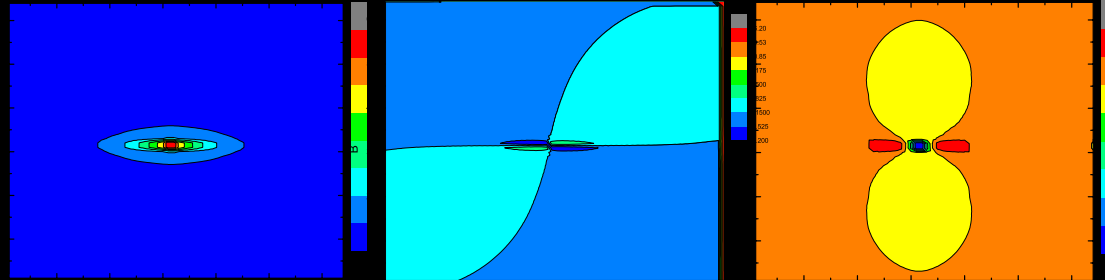
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0.68864232817128	0.76173629416656	0.33430652535202	0.424142596968868
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0.674881517687115	0.84708732655529	0.376767463251114	0.443484395742416
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0.102372184295738	1.320994749848	0.756885316448882	0.53169802797539

Our program

Integrating the 3D magnetic field profile into a 2D I, Q, U map



Stoke I,Q,U map



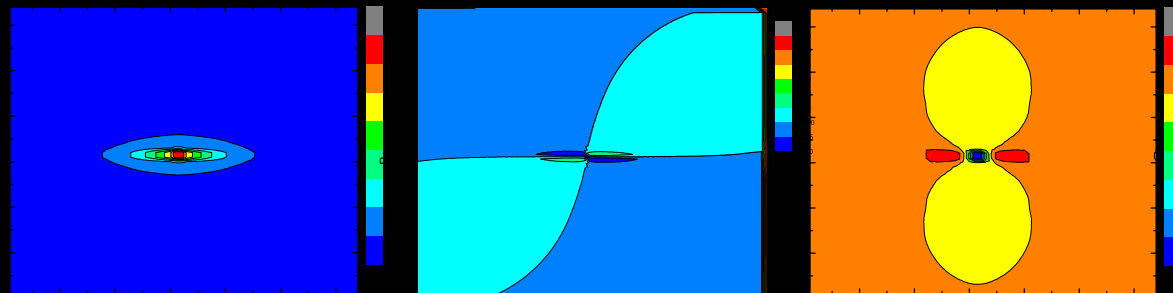
UVGEN in Miriad

Transferring the I,Q,U map into a SMA map

UVGEN in Miriad

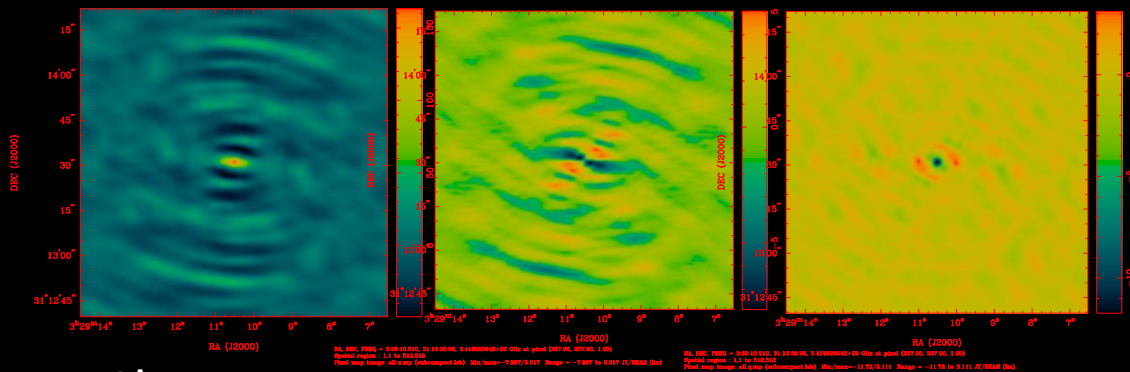
Transferring the I,Q,U map into a SMA map

I, Q, U map



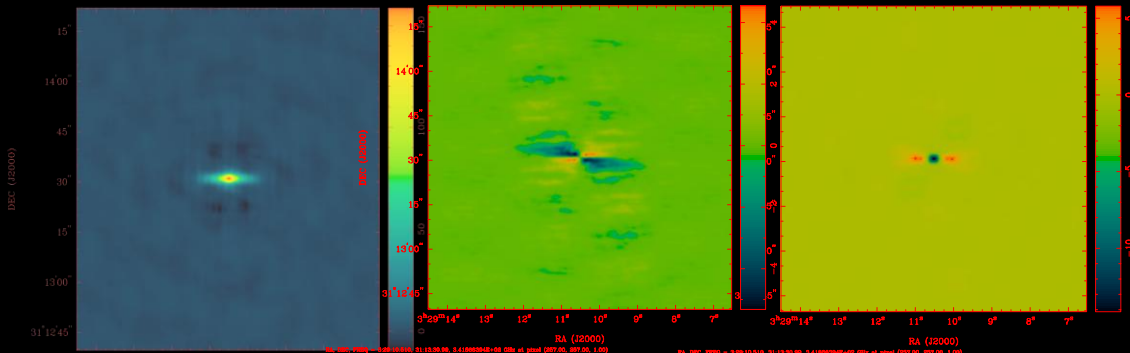
Simulating observations

Dirty map



Clean

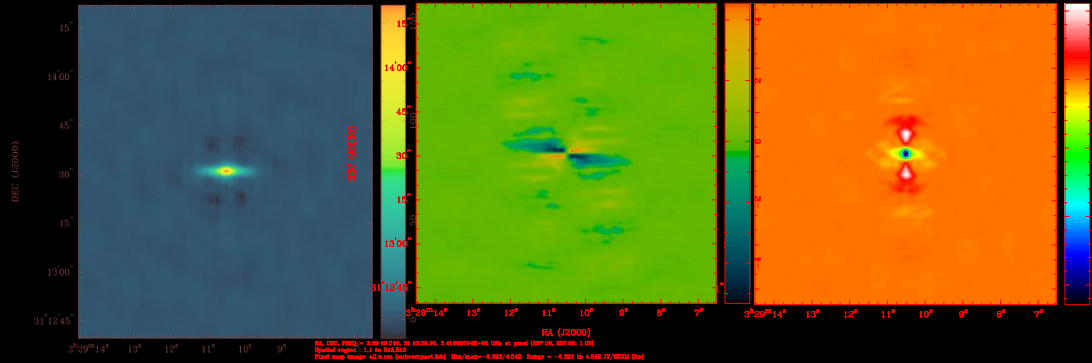
Clean map



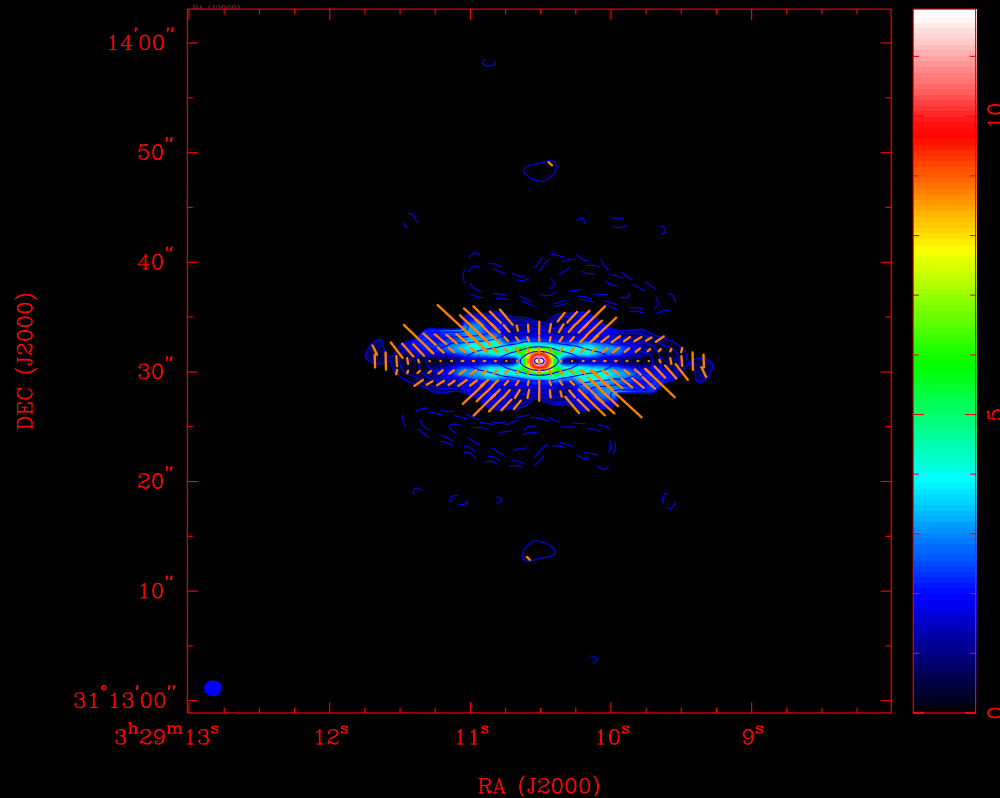
UVGEN in Miriad

Transferring the I,Q,U map into a SMA map

Clean map



SMA
observation
map



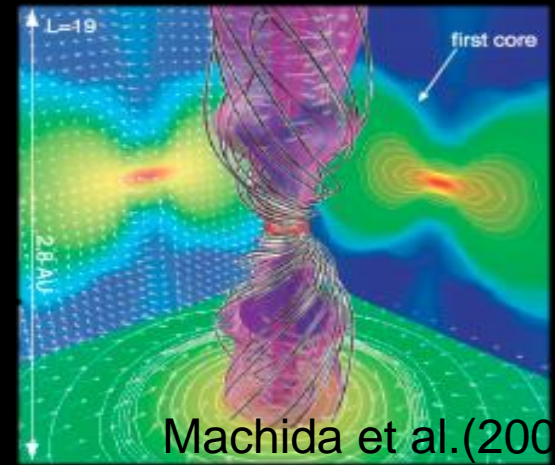
Conclusions

Prof. Machida's group

Providing a model which was generated from some theories



A array that contains the profiles of the density and the magnetic field.



Our program

Integrating the 3D magnetic field profile into a 2D I, Q, U map



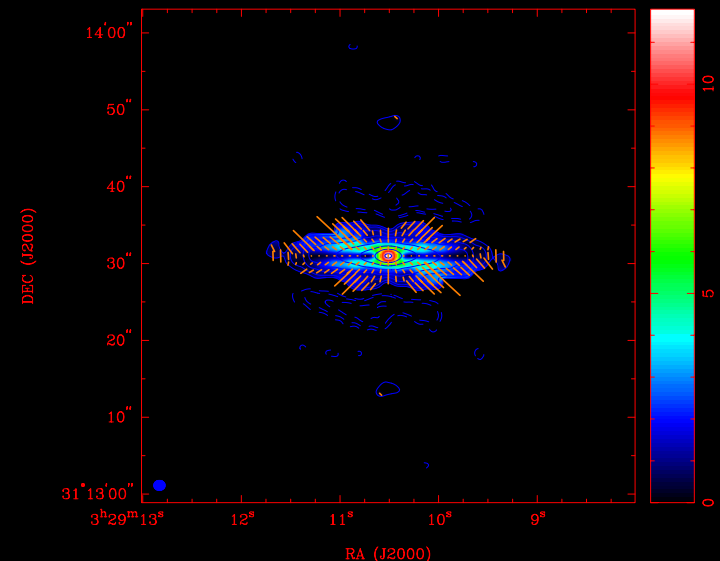
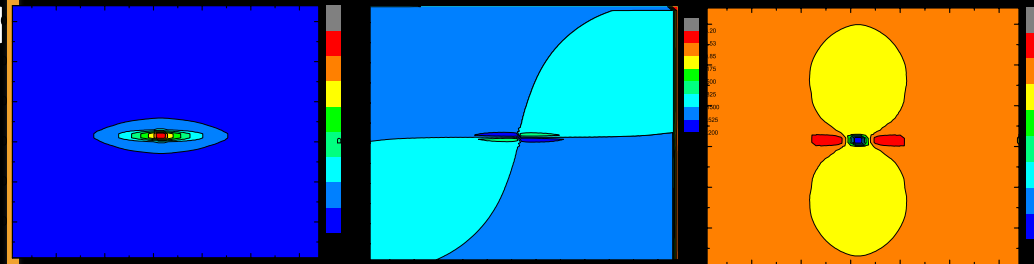
Stoke I,Q,U map

UVGEN in Miriad

Transferring the I,Q,U map into a SMA map



SMA observation map



Any models with density and magnetic field



Our program

Integrating the 3D magnetic field profile into a 2D I, Q, U map



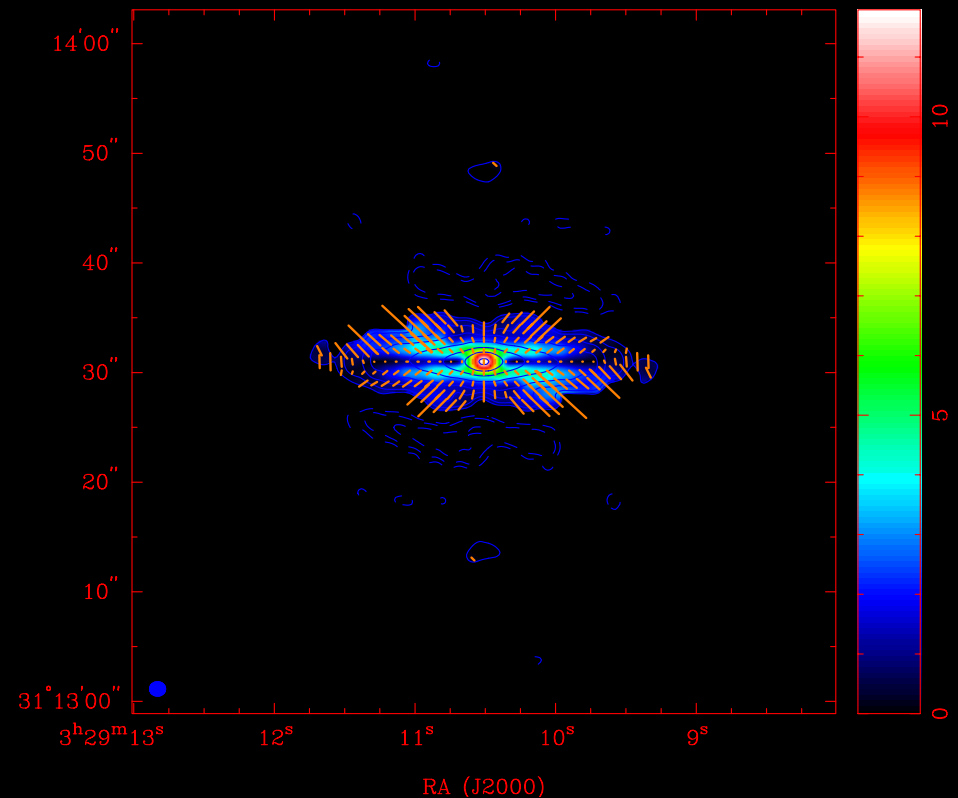
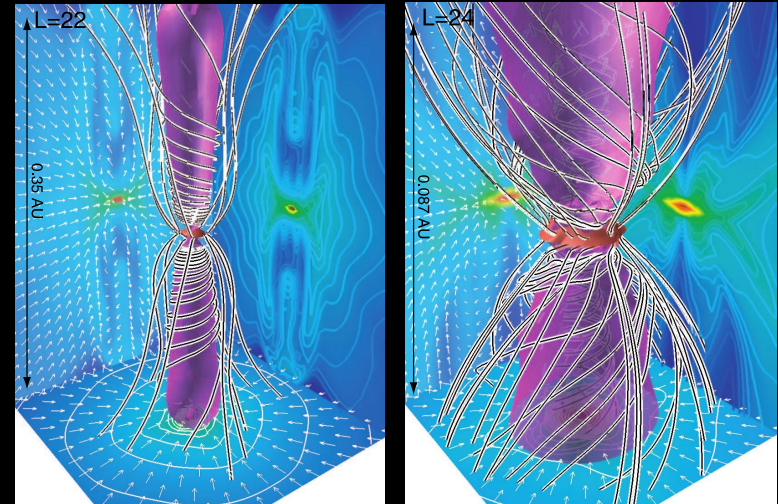
Stoke I,Q,U map

UVGEN in Miriad

Transferring the I,Q,U map into a SMA map



A SMA or ALMA observation map



Thank you