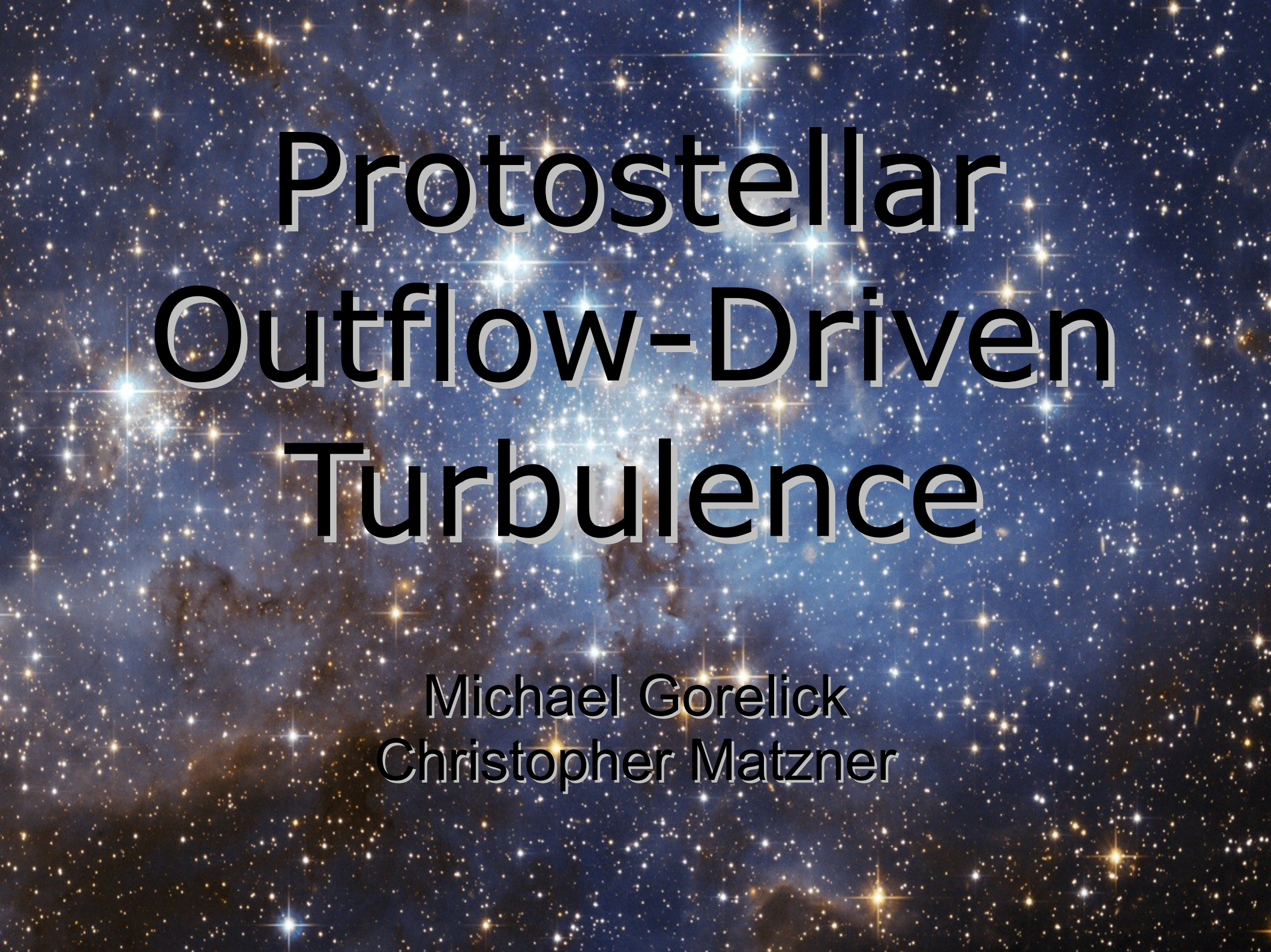

Protostellar Outflow-Driven Turbulence

Michael Gorelick
Christopher Matzner

Background

+ Why: Star formation is a slow process
  - Observed: $SFT_{ff} \approx .19$
  - Theory: $SFT_{ff} = 1$

+ How: Supersonic turbulence in the cloud could be changing environment

+ What: Any source of momentum
  - Protostellar outflows
  - Supernovae (more rare)

Theory:

Stars in their early phases of life, protostars, eject mass through bipolar jets. These jets feedback onto the cloud and create supersonic turbulence. This turbulence acts as a pseudo-pressure inhibiting high star formation rates

Project

+ Model turbulence in cloud numerically and verify predictions
  - Isothermal
  - Coupling factor of outflows
  - Energy Spectrum
  - Line Widths
  - Channel Maps

+ Approximate outflows with spherical regions with impulse
  - Phi dependant impulse for collimation

+ Pseudo-andom outflow injection with respect to space-time
  - Rate parameter: $S \sim \rho^n$

+ Isolate physics to hydrodynamics in order to verify effects are solely caused by outflows

Current

+ Total Variation Diminishing (TVD) Code
  - Strictly momentum Conserving
  - Resolved shocks well

+ Large grid
  - MPI/openmp
  - 200x200x200

+ Constant impulse injection with varied collimation at a constant rate

+ Preliminary Analysis
  - Kinetic Energy
  - Line Widths

+ Numerical Study
  - Verify integrity of results
  - Robertson Interpolation

Future

+ *Finish!*

+ Further analysis

+ Massive Grid
  - 600^3
  - 1000^3?

+ MHD
  - Identify contribution of magnetism

+ Gravity
  - Identify contribution of gravitation
  - More realistic outflow injection


KTHX,
BAI!