Last Updated: February 4, 2012

The **Theory Group** consists of faculty, research scientists, postdoctoral fellows and graduate and undergraduate students working on a broad range of problems in theoretical astrophysics and cosmology, such as:

- **Stellar Astrophysics**
  - Asteroseismology — D. Winget, P. Kumar,
  - Gamma-Ray Bursts — P. Kumar, M. Milosavljevic
  - Neutron Stars — R. Duncan
  - Supernovae — J. C. Wheeler
  - White Dwarfs — D. Winget
- **Planetary Science**
  - Astrobiology — J. Scalo, J. C. Wheeler
  - Planet Formation — S. Dodson-Robinson, J. Scalo
- **Cosmology**
  - Early Universe — E. Komatsu, P. R. Shapiro
  - First Stars and Galaxies — V. Bromm, P. R. Shapiro
  - Fundamental Physics — S. Weinberg
  - Cosmic Reionization — P. R. Shapiro
  - Structure Formation — P. R. Shapiro, E. Komatsu
- **Extragalactic Astrophysics**
  - Active Galactic Nuclei — G. Shields
  - Clusters of Galaxies — M. Milosavljevic, P. R. Shapiro
  - Massive Black Holes — M. Milosavljevic
- **Galactic Evolution**
  - Milky Way Evolution — J. Scalo, P. R. Shapiro, J. C. Wheeler
  - ISM and Star Formation — V. Bromm, J. Scalo, P. R. Shapiro

EVENTS

The group has weekly events to discuss current research of its members and interesting research problems in the astronomical community.

- **Theory Seminars**
  - Scientific talks given by the group members and visitors

- **Astrophysics Lunches**
  - Informal lunch-time discussion meetings

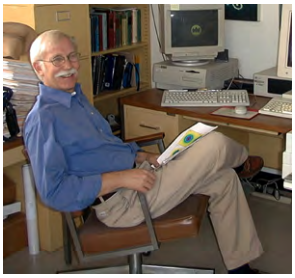
FACILITIES

The members of the Theory Group have access to the state-of-the-art supercomputing facilities at the Texas Advanced Computing Center (TACC; http://www.tacc.utexas.edu/).

- **RANGER** (ranger.tacc.utexas.edu)
  - 3,936 nodes with 4 quad-core AMD Opteron processors
  - 3,936 x 4 x 4 = 62,976 computing cores
  - 32 GB memory per node (123 TB total)
  - Primary storage shared by all nodes = 1.73 PB
  - Local storage per node = 8 GB (31.4 TB total)
- **LONESTAR** (lonestar.tacc.utexas.edu)
  - 1,888 nodes with 2 hex-core Xeon processors (Dell PowerEdge M610)
  - 1,888 x 2 x 6 = 22,656 compute cores
  - 24 GB memory per node (44 TB total)
  - Local storage per node = 146 GB (276 TB total)
  - Global storage = 1000 TB

Stellar Astrophysics

Supernovae



***J. Craig Wheeler*, Professor**

Current Research Activities

- Theory and Observations of Supernovae
- Numerical Simulations of Supernova Explosions
- Stellar Evolution and Stellar Magnetism
- Astrobiology

Members

- Howie Marion (Part-time research fellow)
- Manos Chatzopoulos (Graduate student); Vincent Johnson (Undergraduate student)

Gamma-ray Bursts

***Pawan Kumar*, Professor**

Current Research Activities

- Theory of Gamma-ray Bursts
- Helioseismology
- Tidal Interaction
- Accretion Disks

Members

- Rodolfo Santana (Graduate student); Patrick Crumley (Graduate student); Roberto Hernandez (Graduate student)

White Dwarfs

***Donald Winget*, Professor**

Current Research Activities

- Asteroseismolgy of White Dwarfs
- Extrasolar Planetary Systems around White Dwarfs
- Cosmochronology
- Whole Earth Telescope

Members

- Mike Montgomery (Research scientist); Kurtis Williams (faculty at Texas A&M Commerce)
- Ross Falcon (Graduate student); James Hermes (Graduate student); Sam Harrold (Graduate student); Keaton Bell (Graduate student); Thomas Gomez (Graduate student); Many undergraduate students from Freshman Research Initiative (FRI) program

Neutron Stars and Magnetars

***Robert Duncan*, Research Scientist**

Current Research Activities

- Theory of Neutron Stars and Magnetars
- Soft Gamma-Ray Repeater Outbursts
- Pulsars
- Dynamos and Astrophysical Magnetic Fields
- Quasar Absorption Lines

Planetary Sciences

Astrobiology

***John Scalo*, Professor**

Current Research Activities

- Galactic Evolution and Interstellar Medium
- Turbulence
- Cosmic-Ray Transport
- Astrobiology
- Planetary Atmospheric Evolution; Habitable Planets

Planet Formation

***Sarah Dodson-Robinson*, Assistant Professor**

Current Research Activities

- Planet Formation and Solar Nebula Chemistry
- Planet Discoveries
- Composition of Extra-solar Planet Hosts

Members

- Russell Landry (Research associate); Augusto Carballido (Postdoctoral fellow)
- Mo “Emma” Yu (Graduate student)

Cosmology

Structure Formation

***Paul R. Shapiro*, Professor**

Current Research Activities

- Cosmic Dark Ages and Reionization of the Universe
- Computational and Analytical Studies of Gas Dynamics and Radiative Transfer
- Numerical Simulations of Galaxy and Large-Scale Structure Formation
- Nature of Dark Matter
- Physical Processes in the Interstellar and Intergalactic Media

Members

- Yi Mao (Postdoctoral fellow); Tanja Rindler-Daller (Postdoctoral fellow); Mia Bovill (Postdoctoral fellow); Anson D'Aloisio (Postdoctoral fellow)
- Bohua Li (Graduate student); Hyunbae Park (Graduate student)

First Stars and Galaxies

***Volker Bromm*, Associate Professor**

Current Research Activities

- Computational Astrophysics
- Formation and Evolution of the First Generation of Stars, Quasars, and Supernovae
- Numerical Simulations of Star Formation and Reionization of the Universe
- Chemical Enrichment in the Intergalactic Medium
- Supermassive Black Holes and Globular Clusters

Members

- Andreas Pawlik (Postdoctoral fellow)
- Jacob Hummel (Graduate student); Myoungwon Jeon (Graduate student); Chalence Safranek-Shrader (Graduate Student); Manasvi Lingam (Graduate student)

Early Universe

***Eiichiro Komatsu*, Professor**

Current Research Activities

- Physics of the Early Universe
- Cosmic Microwave Background
- Nature of Dark Energy and Dark Matter

Members

- Jonathan Ganc (Graduate student); Chi-Ting Chiang (Graduate student); Inh Jee (Graduate student); Hyunbae Park (Graduate student)

Fundamental Physics

***Steven Weinberg*, Professor**

Chair of the Theory Group in the Department of Physics

Current Research Activities

- Physics of Elementary Particles and Unification of Fundamental Interactions
- Quantum Field Theory
- Cosmology

Members

- Joel Meyers (Graduate student)

Extragalactic Astrophysics

Active Galactic Nuclei

***Gregory Shields*, Professor**

Current Research Activities

- Theory and Observations of Active Galactic Nuclei
- Ionized Nebulae
- Chemical Evolution of Galaxies
- Quasars and Black Holes

Theoretical and Computational Astrophysics

***Milos Milosavljevic*, Associate Professor**

Chair of the Theory Group

Current Research Activities

- Formation and Early Evolution Massive Black Holes
- Early Galaxies and the Interstellar Medium
- Gamma-Ray Burst Progenitors and the Associated Supernovae
- Relativistic and Plasma Astrophysics
- Computational Methods in Astrophysics

Members

- Andreas Pawlik (Postdoctoral fellow)
- Meghann Agarwal (Graduate student); Chris Lindner (Graduate student); Chalence Safranek-Shrader (Graduate Student); Daniel Kagan (Graduate student); Alan Sluder

(Graduate student); Jeremy Ritter (Undergraduate student); Andy Liao (Undergraduate student)