Linda S. Sparke: Astronomy, UW-Madison

Postdoctoral Scientist advised:

Barbara Pichardo (PhD UNAM, Mexico City; now on UNAM staff) used the 'invariant loop' method (see below) to find gas orbits in circumstellar and circumbinary disks around members of a binary in an eccentric orbit. This new technique can be used in binary systems with arbitrarily high eccentricity.

Ph.D. Students advised:

Stephen E. Levine (Ph.D. Dec. 1992; staff astronomer at U.S. Naval Observatory, Flagstaff, AZ) used a gravitational N-body code to test the stability of self-consistent equilibrium models for 'perfect elliptical disks.' He developed new methods for choosing the orbits and for placing particles on them uniformly so as to provide a 'quiet start.'

Magda Arnaboldi (Ph.D. Oct. 1992 from SISSA, Trieste; on staff at Torino Observatory, Italy and at ESO, Garching, Germany) worked on optical and UV observations of the polar ring system AM2020-504 and examined the stability of self-gravitating polar rings in a triaxial galaxy potential.

Jo E. Pitesky (Ph.D. May 1993 from U. C. Los Angeles; at Jet Propulsion Laboratory, Pasadena, CA) looked at warping modes in a galactic model consisting of a thin cold disk, an oblate bulge free to tilt about its center, and a rigid halo potential. She found long-lived modes in which the bulge was tipped away from the plane of the inner disk.

Andrea L. Cox (Ph.D. August 1996; formerly on faculty at Beloit College, WI; now head of Medical Physics at Tomotherapy Inc, Madison WI) used the VLA radio telescope to map polar ring galaxies in neutral hydrogen, obtaining high-resolution velocity fields for comparison with dynamical models, and searching for diffuse gas around the rings which provides clues to their formation.

Witold Maciejewski (Ph.D. 1998; on the faculty at Liverpool John Moores University, UK) developed the 'invariant loop' technique to examine orbits in a gravitational potential that varies periodically in time. He used this to study the orbits that gas and stars would follow in 'double-bar' galaxies, as the inner bar turns relative to the main outer bar. The fast-tumbling central bar may be important for feeding gas into the galactic center.

Peter Erwin (Ph.D. 2000; scientist at the Max Planck Institute for Extraterrestrial Physics, Garching, Germany) worked on vertical resonances in non-axisymmetric galaxy potentials, including disks around binary stars and 'lopsided' barred galaxies. He used the WIYN telescope for a photometric study of early-type barred galaxies, combining those observations with Hubble Space Telescope archival data to show that central structures such as secondary bars and inner disks are surprisingly common.

Other collaborations with graduate students:

Peter Hofner (Ph.D. 1994; on the faculty at New Mexico Tech, Socorro, NM) investigated the behavior of a galactic disk in a slightly flattened halo potential following an initial perturbation that warps the disk. The inner parts of the disk settle towards a steadily precessing normal mode of bending, while the outer region twists into a spiral form similar to that observed in the gas disks of spiral galaxies. Our paper was published in 1994.

Greg Howard (MS 1994; left for computing job in San Francisco, then PhD in public health, Boston U.) searched for periodic orbits in one 'double-bar' galaxy model, which closed after the inner bar had made an integral number of turns relative to the outer bar.

Wesley Colley (Ph.D. 1997, from Princeton University; on staff at Lincoln Labs, MIT) investigated the motions of gas orbiting in a disk that is tilted away from the symmetry plane of an axisymmetric or triaxial galaxy potential, using a set of 'orbit-averaged' equations to follow the way that the disk settles into an equilibrium state. Our paper appeared in 1996.

Evan Gnam (MS 1997; now physics teacher at East High School, Madison) calculated distribution functions for particles making up the n=1 (spherical exponential) and n=1/2 Sersic models; these are the spherically symmetric density distributions corresponding to the surface brightness observed for dwarf elliptical galaxies. The distribution functions allow us to calculate velocity profiles and velocity dispersions expected for stars at any point in the galaxy.

William Shoemaker (1999-2000; now a science journalist) began reducing optical spectra of gas in polar ring galaxies. He left before finishing MS for an editorial position with Astronomy magazine in Waukesha, WI.

Samuel Friedman (2004-7) investigated possible orbits for the galaxy M33 moving in the gravitational potential of the Milky Way and M31 with the Local Group assumed to be isolated. Indications are that this can explain the observed position, radial velocity and proper motion of M33, without requiring external torques.

Undergraduates supported:

Chris Trinh (U.C. Berkeley undergraduate, summer REU 2006; now in PhD program at UC Irvine) reduced and analyzed multiolor images of polar ring galaxies from the WIYN telescope. He found thin edge-on disks hidden in the central galaxies f two out of his three objects, and presented the work at the AAS meeting in January 2007.

Ben Willett and Cathy Radomski (summer 2002), working with UW-Madison colleague Jay Gallagher, analysed WIYN images of star-forming dwarf galaxies.

Edo Noordermeer (1998-9; 2006 PhD Groningen, Netherlands, then postdoc at Nottingham University, UK). We investigated the orbits that gas would follow in a lopsided galaxy potential. Our paper appeared in 2001.

Nate Bastian (2000-1; 2005 PhD Utrecht, Netherlands; now postdoc at University College London). We applied the 'invariant loop' technique to calculating orbits in gas disks around stars in a binary system. Work subsequently developed further with postdoc Barbara Pichardo.

David Stukel (1990-1) began calculations for orbits in doubly-barred galaxy potentials; project subsequently passed to Greg Howard, then to Witold Maciejewski.

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