

1 Publication List

1.1 Peer review journals and books

- **Porth O.**, Fendt C., Meliani Z. & Vaidya B. (2011), *Synchrotron radiation of collimating relativistic MHD jets*, accepted by **ApJ**
- Vaidya B., Fendt C., Beuther H. & **Porth O.** (2011), *Jet formation in massive young stars: magnetic forces and radiation pressure*, submitted to **ApJ**
- Fiestas J., **Porth O.**, Berczik P. and Spurzem R. (2011), *Evolution of growing black holes in axisymmetric galaxy cores*, submitted to **MNRAS**
- **Porth O.** & Fendt C. (2010), *Acceleration and Collimation of Relativistic Magnetohydrodynamic Disk Winds*, **ApJ** **709**, 1100.
- **Porth O.** & Fendt C. (2010), *From disk winds to relativistic jets*, Proceedings of the Workshop HEPRO II, **Modern Physics D**, Volume 19, Number 6, p. 677
- Ernst A., Just A., Spurzem R. and **Porth O.** (2007), *Escape from the vicinity of fractal basin boundaries of a star cluster*, **MNRAS** **383**, 897

1.2 Publication in journals or books without peer review

- **Porth O.** (2010), *Two component relativistic acceleration and polarized radiation of the parsec-scale AGN jet*, Proceedings of the International Astronomical Union, IAU Symposium 274
- Fendt C., Vaidya B., **Porth O.**, Sheikh Nezami S. (2010), *MHD simulations of jet formation - protostellar jets & applications to AGN jets*, Proceedings of the International Astronomical Union, IAU Symposium 275
- **Porth O.** (2010), *Simulations and synchrotron radiation from the relativistic jet base*, Proceedings of the Workshop “Steady Jets and Transient Jets”, *Memorie della Societa Astronomica Italiana*
- Fiestas J., **Porth O.** & Spurzem R. (2008), *Dynamical Evolution of Rotating Globular Clusters with Embedded Black Holes*, Proceedings of the International Astronomical Union, IAU Symposium, Volume 246, p. 166

1.3 Abstracts of presentations

1.3.1 Scientific talks

- *Two component acceleration and polarized emission of the inner parsec-scale jet*
Conference “Accretion and Outflow in Black Hole Systems”, Kathmandu, Nepal, October 11–15, 2010

We show the results of large scale axisymmetric simulations of two-component jet acceleration in special relativistic magnetohydrodynamics. Within one parsec from the accretion disk, the component dominated by Poynting flux accelerates to relativistic velocities $\Gamma \sim 10$ but is still far from equipartition. Thermal acceleration of the inner component saturates quickly after the sonic point but is delimited to $\Gamma \sim 3$ by the amount of enthalpy available in the black hole corona. In the near-stationary end-state, we solve the polarized Synchrotron radiation transport incorporating self-absorption and (internal) Faraday rotation. With mock-observations of the jet base in radio and sub-mm wavelength we show the resolution dependence of the transversal rotation measure gradients. Models that seem to break the λ^2 -law in the radio band can yield consistent rotation measures when observed in the ALMA frequency range.

- *From disk winds to relativistic jets*
Workshop “High Energy Phenomena in Relativistic Outflows II”, Buenos Aires, Argentina, October 26–30, 2009

We investigate the relativistic acceleration and collimation of a wind launched from a magnetized accretion disk corona. Time-dependent simulations of the full set of special relativistic magneto hydro dynamic (RMHD) equations are performed with the publicly available PLUTO code. In order to provide an injection boundary in dynamical equilibrium, Newtonian gravity was added as source term. The flow starts out with sub-escape velocity and we allow for sub magnetoslow injection to consistently prescribe the mass-loading. The detailed trans field and parallel field force-balances are shown with highlights on the relativistic contribution due to electric fields. Generally we find collimated flows with mass-weighted half-opening angles of 3-7 degrees and mildly relativistic velocities. The outer subrelativistic flow is a promising candidate for the X-ray absorption winds that are observed in many radio-quiet active galactic nuclei (AGN).

- *MHD simulations of relativistic jet formation*
Workshop “The high-energy astrophysics of outflows from compact objects”, Ringberg, Germany, December 7–13, 2008

We show the first results of jet acceleration and self-collimation simulations in the relativistic regime where the jet is launched from an accretion disk corona. The jet starts out as a sub-escape velocity wind and is accelerated to mildly relativistic velocities with $\Gamma \sim 3$ by the magnetocentrifugal force. We can follow the evolution until a stationary state is reached within the computational domain and find both of the initially paraboloidal and split monopole field geometries to collimate well with half-opening angles $\sim 1^\circ$.

- *Binary black holes in triaxial galaxies*

Workshop “N-body 2008”, Turku, Finland, August 10–14, 2008

Binary black hole coalescence is of great interest with respect to the possible detection of gravitational waves and the galactic merger history. On the event of a galactic merger, the black holes will quickly come in range of one parsec due to dynamical friction. In spherical galaxy models this marks an unpenetrable barrier since the relaxation driven hardening is not working any more and the emission of gravitational waves not yet efficient enough. Most likely a merging galaxy will not well be described by the spherical assumption. We investigate the contribution due to relaxation & centrophilic orbits on binary black hole hardening in triaxial direct Nbody models. Our oblate models still show scaling of the hardening rate with the number of simulated particles (relaxational hardening) while the prolate models with strong contribution of box orbits show a significantly smaller dependence on the particle number.

1.3.2 Poster presentations

- *Signatures of Synchrotron Radiation from the Relativistic Jet Base*

Conference “Understanding Relativistic Jets”, Krakow, 22–26 May, 2011

We show the results of large scale axisymmetric simulations of two-component jet acceleration in special relativistic magnetohydrodynamics. Within one parsec from the accretion disk, the component dominated by Poynting flux accelerates to relativistic velocities $\Gamma \sim 8$ but is still far from equipartition. Thermal acceleration of the inner component saturates quickly after the sonic point but is delimited to $\Gamma \sim 3$ by the amount of enthalpy available in the modeled black hole corona. In the near-stationary end-state, we solve the polarized Synchrotron radiation transport incorporating self-absorption and (internal) Faraday rotation. With mock-observations of the parsec scale jet base in radio and sub-mm wavelength we obtain observational signatures of the model. These comprise radio maps, spectra, polarization structure (revealing spin direction), frequency dependent depolarization, core shift and Faraday rotation measure. We also specify the detectability of such features depending on the available resolution, predicting the discovery of non monotonic rotation measure gradients with the advance of space-VLBI and mm-VLBI featuring resolutions of 100 Schwarzschild radii. The presented work represents a complete toolbox to test the present diagnostics used in radio observations of AGN cores.

- *Two component relativistic acceleration and polarized emission of the inner parsec-scale jet*
IAU Symposium 274 “Advances in Plasma Astrophysics”, Giardini Naxos, Italy, 6–10 September, 2010

We perform axisymmetric simulations of two-component jet acceleration using the special relativistic MHD code PLUTO. The inner, thermally driven component constitutes a dilute relativistic plasma originating in a high enthalpy central corona. The second component is a Poynting-dominated wind driven by a global current system. Once a near-stationary state is reached, we solve the polarized Synchrotron radiation transport incorporating self-absorption and (internal) Faraday rotation. With this approach we obtain high-resolution radio maps and spectra that can help in the interpretation of observational data from nearby active galactic nuclei by predicting spine-sheath polarization structures and Faraday rotation gradients.

- *Jet Acceleration and Synchrotron Maps of the Simulated Jet Base*

Workshop “Steady Jets and Transient Jets”, Bonn, Germany, April 7–8, 2010

The central acceleration region of active galactic nuclei (AGN) is simulated for a two-component spine and sheath jet. For the steady jet component we perform the spatially resolved polarized synchrotron transfer producing observables as radio maps, spectra and derived rotation measures. The wealth of detail obtained this way helps to assess the physical processes (such as internal Faraday rotation) and model assumptions.

- *Relativistic Jet collimation and acceleration*

Workshop “Physics of Galactic Nuclei”, Ringberg, Germany, June 15–19, 2009

In the scenario of jet-formation suggested by Blandford & Payne (1982) jets are launched as magnetized winds emanating from an accretion disk. As magnetized disks are found around a variety of jet-producing astrophysical objects from young stellar objects towards active galactic nuclei, the suggested disk-wind scenario can be seen as a unified picture of jet formation. We investigate how relativistic outflows become accelerated and collimated using the special relativistic Magneto-Hydro-Dynamics code PLUTO 3. Special focus is on the relativistic contribution to collimation “beyond the light cylinder” and conversion of Poynting-flux into kinetic energy.