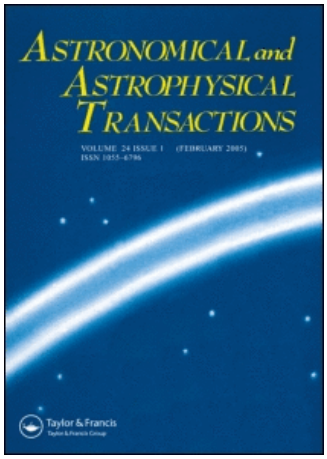


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# FLARES AND FLASHES: IAU COLLOQUIUM No. 151

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IAU Colloquium No. 151 "Flares and Flashes: View from the Ground and Space" was held in Sonneberg, Germany, December 5–9, 1994. Over 100 astronomers from 27 countries (representatives of all continents except Australia) gathered in the townhall in Sonneberg where all the scientific sessions took place. During five working days 13 scientific sessions were held with over 50 invited discourses and oral contributions presented plus about as many poster reports submitted, their topics covering a wide range of research on stellar flares and flashes. A round table discussion "Flares and Flashes: Past and Future" was organized following the scientific sessions and an introductory meeting for those who would like to join the working group on All Sky Patrol Astrophysics (ASPA project) was given by the hosts. A public lecture "Das Leben der Sterne" was presented by Professor R. Kippenhahn (Göttingen) after the first evening session. The scientific Organizing Committee headed by Professor H. W. Duerbeck (Astronomisches Institut der Universität Münster), Professor R. E. Gershberg (Crimean Astrophysical Observatory), Dr J. Greiner (Max–Planck–Insitut für Extraterrestrische Physik, Garching) and the secretaries Mrs B. Ott and Mrs A. Wicklein had done much preparatory work to create excellent working conditions for the participants. In addition to the rich scientific programme, visits to Sonneberg observatory, Coburg, the historical centre of the Tübingen region, Sonneberg toy museum and the famous Lausch glass museum were organized for attendees of the Colloquium. IAU Colloquium No.151 was sponsored by the IAU, Soros Science Foundation, federal government and local authorities of the Tübingen region. Specifically, over 30 000 DM were allocated for grants to enable participation in the colloquium for nearly 30 astronomers from former USSR countries.

The Sonneberg colloquium was convened in honour of the 65th birthday of the world-renowned German astronomers G. A. Richter and W. Wenzel, who discovered, classified and investigated the variability of hundreds of intrinsic variable stars, binary systems and other variable objects.

As one can see from a full list of topical sessions presented below, practically all known types of flaring stellar objects were on the agenda in Sonneberg: (1) opening

and introductory overviews (solar flares, flares: the solar-stellar connection); (2) flares in late-type stars, radio and optical; (3) flares in late-type stars: UV and X-ray; (4) flares in T Tau stars; (5) theory of flares; (6) eruptions of cataclysmic variables; (7) flickering in cataclysmic variables; (8) and (9) high-energy transients; (10) and (11) gamma-ray bursts; (12) sky patrols; (13) all sky monitoring: UV to gamma-rays. Two somewhat interrelated topics dominated discussions at the Sonneberg colloquium: gamma-ray bursts and the *ASPA* project.

Despite intensive research, both observational and theoretical, the mystery of the nature and origin of gamma-ray bursts (GRB) has persisted over two decades. Below are listed only the most important of the bizarre properties of GRB. All of them are unique phenomena never repeated in the same position in the sky. One of the most striking peculiarities of GRB is a pronounced isotropy of the GRB distribution (over 1200 events being registered by the Burst and Transient Source Experiment (BATSE) onboard the Compton gamma-ray observatory) coupled with the pronounced scarcity of weak GRB. Their durations range from about 10 ms to over 1000 s, no periodic structure has ever been seen in GRB, no spectral lines identified, almost all of the power is emitted above 50 keV. The basic problem is the absence of quiescent or transient counterparts at other wavelengths, resulting in distance scale uncertainties of more than 10 orders of magnitude. Over 100 theories of the origin of GRB have now been catalogued. The most favoured interpretation of GRB suggests that they originate at large redshifts due to merging of compact stellar objects (neutron stars, black holes, white dwarfs). Mergers are expected to occur at a rate of $\sim 10^{-6}$ per year and per host galaxy. So that recurrence over the life time of gamma-ray detectors is not expected. Therefore, much of the discussion during the colloquium centred on the problems of the best strategy to search for counterparts in different energy windows using various techniques. Information concerning various ongoing projects aimed at this goal has been summarized. *BACODINE* (*BATSE* Coordinate Distribution Network) after detecting a GRB impulse calculates approximate coordinates for the burst and distributes them to other centres and groups (21 groups were collaborating with *BACODINE* at 34 sites around the world at the time of the Sonneberg colloquium). Observations of GRB onboard the *GRANAT* observatory and with the aid of EGRET (energetic gamma-ray experiment telescope) were conducted; the latter discovered delayed emission of $> 30$ MeV to GeV photons long after some GRB, whose nature also remains a mystery. Investigators from nine observatories study photographic plates which have been exposed simultaneously with GRB detected by BATSE (Greiner *et al.*). A deep search for optical counterparts of GRB is currently underway at the 6-m telescope of the Special Astrophysical Observatory (Sokolov *et al.*). An explosive transient camera, unautomated wide-field sky monitor was designed to detect short time-scale optical transients in real time (Vanderspek and Ricker). The concept of an optical transient monitor (Hudec) and of wide-field cameras for GRB observations in X-rays and EUV (Moskalenko) has been presented.

An ambitious future project, ASPA, aimed at revival of and updating sky patrol observations at Sonneberg observatory has been formulated by a working group of German astronomers and presented by Professor N. Vogt. *ASPA* has a number of

aims. (1) Developing and establishing a world-wide network of about six identical semi-automatic observing stations, each consisting of 24 cameras (20 cm aperture) on a common mounting. Each camera is equipped with a CCD frame of 2048X2048 pixels reaching a limiting magnitude $18^m$ to $19^m$ with a photometric accuracy and an exposure time of several minutes. (2) Establishing an international centre for acquisition, reduction and distribution of the CCD data. (3) Carrying out and completing the digitization of existing plate archives. As to the astrophysical impact of *ASPA*, the following objects should be on a target list: quasars, AGN, supernova search, globular clusters, optical counterparts of GRB, gravitational lensing events, etc. An overview of the current state of plate collections with a special emphasis on the problems pertinent to flare stars was given by representatives of the Harvard college observatory, the Sternberg Astronomical Institute, the Odessa observatory, the Abastumani observatory and the Bulgarian Institute of Astronomy.

In view of all the above-mentioned, elucidation of the physical processes behind the bursts in compact objects are of great importance. Combining information from the cooling track and the radius expansion track after the X-ray burst occurring on a neutron star one can specify the mass and the radius of the compact object (van Paradijs and Lewin) whereas analysing the power spectrum for quasi-periodic oscillation and noise one can classify low-magnitude field neutron stars and distinguish between them and accreting black holes (van der Klis).

Although most of the contributions presented at Sonneberg centred on observations of flares in T Tau, RS CVn, UV Ceti, dMe, Algol-type stars, cataclysmic variables, etc. seen in the optical region, UV, X-ray, radio waves and their analysis, is the tendency to use a multi-wavelength approach, new techniques are also in evidence in this field. The advantages of such an approach have been demonstrated for simbiotic Nova PU Vul where a long-lasting international campaign has enabled a direct tracing of observed evolution over the last 15 years by a confrontation of observations with the evolutionary tracks (Gershberg). A similar strategy has now been applied to investigate the red dwarf EV Lac and the possible discovery of a flaring gamma-ray source near it was reported (Alekseev *et al.*). The advantages of new techniques for studying optical variable objects at ultra-short time-scales (down to hundreds of nanoseconds) using the MANIA complex at the Special Astrophysical observatory for studying pulsars, X-ray novae, supernova remnants and a new quantum-optical spectrometer at La Palma observatory were indicated (Beskin and Dravins). The first results and potential of an automated search for flare stars in stellar aggregates from photoplates in combination with a PDS microdensitometer and their identification in existing catalogues and data bases were summarized (Tsvetkov *et al.*). The importance of using archival data for statistical studies of flare stars has been demonstrated for dwarf novae (la Dous) where homogeneous records of IUE low-resolution spectra exist. Although the questions of kinematics, space densities, the relation of flare stars with stellar aggregates, and evolutionary effects have been addressed in some reports (Mirzoyan *et al.* and Duerbeck) their scarcity underscores the large potential of archives for various statistical studies and also in a broader context, for instance, for elucidation of the possible role of dwarf stars as a potential source of seed particles for cosmic rays (Shapiro).

The participants at IAU Colloquium No. 151 "Flares and Flashes" unanimously passed a resolution "An Appeal to Save Sonneberg Observatory" in which they expressed their utmost concern about the plans to close the Sonneberg observatory and supported the *ASPA* project as the best means for continuity and updating unique sky patrol observations at Sonneberg.

The monograph "Flares and Flashes" based on materials from IAU Colloquium No. 151 has appeared recently in hard cover published by Springer Verlag (editors: J. Greiner, H. W. Duerbeck, and R. E. Gershberg).