**Layout for a partner-wide exoplanet survey**

**PEPSI key-science project „The LBT exoplanet deep spectrum project“**

Dear colleagues,

this call is circulated among all LBT partners to seek collaborations in the definition of a wide survey with the PEPSI spectrograph at LBT to be proposed for execution in the next two years. The goal of this announcement is to solicit contributions and declaration of interests among all LBT partners to be discussed in a virtual workshop that will be organised in the fall.

The survey is being proposed by the PEPSI P.I., Klaus G. Strassmeier, and is open to all interested LBT partners as Co-Investigators.

The survey would aim at several different but interrelated science cases, targeting stars with known exoplanet transits, to best exploit the unique PEPSI capabilities. It will be designed around observations of a number of transits at high spectral resolution and high time cadence, using also the same and additional spectra for a detailed characterization of the respective host stars beyond what is usually possible in a single observing run.

The strengths and uniqueness are the combination of PEPSI's spectral resolution and throughput with the light-collecting power of the LBT in binocular mode plus the realization of a proper time sampling from minutes up to the orbital period of the planet. Key instrumental numbers like, for example, the resolution $\times$ wavelength coverage $\times$ S/N product are only matched by the VLT and ESPRESSO in the southern hemisphere. The project would be unique in the northern hemisphere.

Moreover, flexible scheduling of the observations (e.g., immediate repetition or follow up in another wavelength) will be possible because PEPSI is on stand-by all the time and its PFU-AGw used in remote control. Recent TESS targets will be incorporated as well. A typical use case is monitoring a transit in two wavelength ranges (two PEPSI cross dispersers) at $R$=130,000 and then re-observing the target with the other cross dispersers outside of transit in a mild (orbital) phase-dependent scheduling, that is, covering for example the planet eclipse or its quadrature phases. Some unique targets with circum-planetary material may be monitored throughout a full orbital cycle in high cadence for science related to star-planet relations.

The P.I. team will offer two key contributions to the survey:

- Full reduction of all the data collected in the program with the dedicated pipeline;
- 10 observing nights from the granted GTO.

It is anticipated that data will be provided to the program Co-Is with a *tbd* proprietary period after which the data will be made public. Details for the data exploitation within the proposing consortium will be discussed between the participants.

At the moment, we envision a time request of 40 clear nights over the next two years, starting in 2021A, with on average 10 nights per semester. Weather losses must be mitigated, an issue that will explicitly be addressed in the proposal with alternative rescheduling of the transits.

Anyone interested in contributing to the science case and the organization of the survey can directly contact Klaus at kstrassmeier@aip.de.

The plan is to organize informal discussions to brainstorm about the project and organize a virtual workshop to present the various contribution. The goal is to have a proposal in place in early Fall this year.

We attach below a brief description of PEPSI and its key capabilities.

A panopticum of recent papers based on PEPSI data and an updated exposure-time calculator are available at https://pepsi.aip.de/.

In its Permanent Fiber Unit (PFU) mode PEPSI is available with three spectral resolutions, *R*, averaging 50,000, 130,000, and 250,000 over the 385-915nm wavelength range. The default pixel sampling is now two pixels per resolution element for all resolutions. A high-sampling mode for *R*=50,000 with 12 pixels, and for *R*=130,000 with 4 pixels, is still available on demand. Fiber sky apertures for the three resolutions are 2.3", 1.5", and 0.74", respectively. Under good weather conditions with seeing of 1" and moderate air mass, a 10-min integration of a 10.0-mag G2 star yields a S/N per pixel of 520/370 for cross dispersers (CD) 5/3 at *R*=50,000, 250/170 for CD5/3 at *R*=130,000, and 80/55 for CD5/3 at *R*=250,000. Thus, a practical brightness limit for exoplanet transits appears to be around V=15$^{th}$ magnitude at *R*=50,000 in 20-min exposures when a S/N per pixel of 60 is achieved in the most efficient CD 5. Radial velocity (RV) stability is independent of the observing mode but resolution, stellar spectral morphology, intrinsic line broadening, and S/N limit the RV precision to ≈1 m/s over a few hours of a transit and not better than ≈5 m/s over an observing semester.