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Chronological overview

- 10/1994–09/1998 BSc in Physics, Sharif University of Technology, Tehran, Iran
- 10/1998–08/2000 MSc in Physics, Institute for Advanced Studies in Basic Sciences, Zanjan, Iran
- 01/2001–10/2002 military service, Iran
- 01/2003–07/2004 teaching, Damghan University of Basic Sciences, Iran
- 09/2004–06/2005 visitor, Max-Planck Institut für Radioastronomie, Bonn, Germany
- 07/2005–12/2005 research assistant, Kiepenheuer–Institut für Sonnenphysik, Freiburg, Germany
- 01/2006–10/2008 PhD in Physics, Kiepenheuer–Institut für Sonnenphysik, Freiburg, Germany
- 10/2008–10/2011 Postdoc scholar, Kiepenheuer–Institut für Sonnenphysik, Freiburg, Germany
- 10/2011–10/2015 DFG Postdoc, Kiepenheuer–Institut für Sonnenphysik, Freiburg, Germany
- 11/2015–10/2018 Generic Postdoc, Instituto de Astrofísica de Canarias, Tenerife, Spain
- 11/2018–present Assistant professor, Sharif University of Technology, Tehran, Iran

Education

- PhD (astrophysics)
  Project: Magnetic coupling of the solar photosphere and chromosphere
  Supervisors: Prof. Wolfgang Schmidt.
  Kiepenheuer–Institut für Sonnenphysik and Albert-Ludwig Universität Freiburg, Germany.
- MSc (gravitation & astrophysics)
  Project: Detection of short period intensity oscillations in the solar corona observed during the total solar eclipse, August 11, 1999.
  Supervisors: Dr. Jagdev Singh, Indian Institute for Astrophysics, Bangalore, India, and (late) Dr. Mehdi Jahan Miri.
  Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran.
- BSc (atomic physics)
  Project: Constructing a high frequency discriminator for gamma–ray detectors.
  Supervisor: Prof. Jalal Samimi.
  Sharif University of Technology, Tehran, Iran.

Awards and Grant

2006 Kiepenheuer–Institut für Sonnenphysik offered financial support for a PhD program.
2011 Awarded Deutsche Forschungsgemeinschaft (DFG) Research Grant as PI.
2015 In a second application, an extension of my DFG grant was awarded to cover a PhD student.

Teaching Experience

2003-2004, Damghan University of Basic Sciences, Damghan, Iran.
Courses: modern physics, basic physics, astronomy, astrophysics, space physics, and labs.

Community Service

Acting as a referee for the following Journals: Astrophysical Journal, Astronomy & Astrophysics, Solar Physics, and Publications of the Astronomical Society of Japan.
I wrote a reduction package for the IRIS spectral data (MOSiC) which is available in the SolarSoft package.

Professional skills

- **Observational skills** Performing a wide range of observations through the last two decades in major solar telescopes across the globe, I have gained invaluable expertise in experimental physics. Spectral lines and Stokes profiles are source of the majority of our knowledge in astrophysics as they carry fingerprints of the fundamental physical processes. I have observed the solar photosphere, chromosphere, and transition region from ultraviolet to near-infrared wavelengths using a variety of spectropolarimeters. Understanding the atomic physics is necessary to decode the hidden information in Stokes spectra to infer the physical parameters of the solar atmosphere. Depending on the goals of the observing campaign, I have explored different techniques to record the relevant data like photometry, spectroscopy, spectropolarimetry, and high spatial resolution 2D imaging from ultraviolet to near infrared. Satellite data are used for other bands like x-rays and extreme ultraviolet which are not accessible from the ground. I am also member of a group of scientists supporting the two upcoming 4 m solar telescopes (DKIST, EST).

- **Advanced data analysis** Costly experimental data acquired through complex process of applications for different instruments deserves nothing less than an optimal data calibration and analysis. I have developed routines to calibrate and analyze the spectropolarimetric data mentioned above. Spectropolarimetric data are usually subject to inversion techniques with different level of sophistication to infer the stratification of the physical parameters in the solar atmosphere (temperature, velocity, magnetic field vector, ...). Several examples of inversion methods appeared in my publications. In addition to spectral inversion, I have also synthesized spectral lines in a variety of three-dimensional numerical simulations of quiet and active regions of the Sun to compare them with observations. The vast difference between the best spatial resolution in observed data (≈ 50 km) and the spatial grid size of the recent magnetohydrodynamic models (≈ 1 km) requires a detailed process to properly compare the two datasets. The imaging data demands a different kind of analysis tools as they mostly suffer from the turbulence in the earth atmosphere (seeing). One usually applies the speckle technique to bursts of images and constructs a high-resolution image. The spatial resolution of the final image usually is comparable to the theoretical spatial resolution of the optical train. Mitigating noise, fringes, calibration artifacts, ... is where advanced data analysis tools like wavelets and machine learning shine.

- **Bayesian fitting technique** There are several traditional methods to solve the standard problems like regression. Beside the least-square method which explicitly assumes Gaussian errors in the measured data, a variety of statistical methods became popular like the Bayesian inference, genetic algorithms, statistical annealing, ... In the Bayesian inference, one estimates the probability distribution of the parameters (posterios), which is far more informative than just estimating a single number. Although the statistical approaches are computationally expensive compared to the least-square method, the advancements in High Performance Computing (HPC) made it possible to utilize

complex Bayesian techniques like Bayesian inversions. I have used Bayesian methods to solve problems with known error on both axis, performing regression as well as calculating the Bayes factor to quantitatively discriminate between different models.

Students supervised

- **Master student** C. Kiess, 06/2013, Uni Freiburg, title:"Cycle Dependence of Sunspot Properties". The work led to a publication in Astronomy & Astrophysics, Vol. 565, A. 52, 2014.
- **Summer student** I have supervised summer students both in Germany and Spain. This includes training students for a basic physical understanding, observations, and data analysis.

International collaborations

2016 Dr. C. Fischer, Kiepenheuer Institut für Sonnenphysik, Freiburg, Germany.

2015 Dr. O. Steiner, Istituto Ricerche Solari Locarno, Locarno, Switzerland.

2015 Prof. M. Sobotka, Astronomical Institute of the Academy of Sciences, Ondrejov, Czech Republic.

2012 Dr. M. Cheung, Lockheed Martin Solar and Astrophysics Laboratory, US.

2010 Dr. B.W. Lites, High Altitude Observatory, Boulder, US.

2007 Dr. L. Bellot Rubio, Instituto de Astrofisica de Andalucia, Granada, Spain.

2006 Dr. C. Beck, National Solar Observatory, Boulder, US.

2005 Dr. F. Paletou, THEMIS solar telescope, Toulouse, France.

2004 Prof. P. Biermann, Max-Planck Institut für Radioastronomie, Bonn, Germany

1999 Dr. J. Singh, Indian Institute for Astrophysics, Bangalore, India.

Talks

07/2020 Recent Advances in Solar Physics, ZANJAN, Iran

06/2020 Solar observation techniques, Tehran, Iran

11/2019 Mercury Transit, Tehran, Iran

07/2019 Relation between the solar activity and Eath climate, Science Musume, Tehran, Iran

06/2019 Relation between the solar activity and Eath climate, School of Astronomy, IPM, Tehran, Iran

01/2018 DKIST Science workshop, Kiepenheuer-Institut für Sonnenphysik, Freiburg, Germany (invited)

05/2017 Istituto Ricerche Solari Locarno, Locarno, Switzerland (invited)

04/2017 Kiepenheuer-Institut für Sonnenphysik, Freiburg, Germany

08/2016 School of Astronomy, Institute for Physics and Mathematics, Tehran, Iran

04/2016 Space Weather 6 conference, Levi, Finnland (invited)

05/2015 Instituto de Astrofísica de Canarias, Tenerife, Spain

03/2015 Dunn Solar Telescope, National Solar Observatory, Sunspot, US

04/2015 Instituto de Astrofísica de Canarias, Tenerife, Spain

01/2015 GREGOR Infrared Spectropolarimeter (GRIS) internal meeting, Madrid, Spain

08/2014 COSPAR general assembly, Moscow, Russia

06/2014 GRIS internal meeting, Max-Planck Institut für Sonnensystem, Göttingen, Germany

02/2014 SUNRISE II workshop, Max-Planck Institut für Sonnensystem, Göttingen, Germany

08/2014 Extracting information from spectropolarimetric observations, (ISSI) Bern, Switzerland

12/2012 Extracting information from spectropolarimetric observations, (ISSI) Bern, Switzerland

11/2011 Filamentary Structure and Dynamics of Solar Magnetic Fields, (ISSI) Bern, Switzerland

03/2010 Flux emergence in Hinode era, Mullard Space Science Laboratory, UK

08/2009 Institute for Physics and Mathematics, Tehran, Iran

09/2008 European Solar Physics Meeting (ESPM-12), Freiburg, Germany

04/2008 Deutsche Physikalische Gesellschaft (DPG) meeting, Freiburg, Germany

03/2008 Institute for Physics and Mathematics, Tehran, Iran

09/2007 Solar Polarization Workshop (SPW5), Ascona, Switzerland

05/2007 Instituto de Astrofisica de Andalucia, Granada, Spain

04/2007 Physics department, Sharif University of Technology, Tehran, Iran

12/2006 Kiepenheuer-Institut für Sonnenphysik, Freiburg, Germany

03/2005 Max-Planck Institut für Radioastronomie, Bonn, Germany

01/2005 Kiepenheuer-Institut für Sonnenphysik, Freiburg, Germany

01/2003 Astrophysical meeting, Mashhad University, Mashhad, Iran

01/2000 Astrophysical meeting, IASBS, Zanjan, Iran

Poster presentations

09/2014 Astronomische Geselschaft meeting, Bamberg, Germany

09/2011 Astronomische Gesellschaft meeting, Surveys & Simulations, Heidelberg, Germany

09/2010 Hinode-4 Conference, Palermo, Italy

09/2009 First EAST-ATST Workshop, Freiburg, Germany

09/2007 Astronomische Gesellschaft meeting, Cosmic Matter, Würzburg, Germany

09/2006 Modern Solar Facilities, Göttingen, Germany

Schools

06/2009 USO School "Solar Magnetism", Dwingeloo, The Netherlands

09/2004 Neutrino Physics: from the Laboratory to the Cosmos, Bad Honnef, Germany

08/1997 The 23-rd International School for Young Astronomers (ISYA), IASBS, Zanjan, Iran

03/1997 The first advanced astronomy school, Shiraz University, Shiraz, Iran

Observing Grants

- **German Vacuum Tower Telescope (VTT)** I had in total about five months observation time during 20 observing campaigns from 2006 till 2017. I have practiced most of the post-focus instruments available at VTT (spectropolarimeters, spectrograph, Fabry-Pérot 2D-interferometer) and the adaptive optic (AO) system. The AO system provides real-time image correction to compensate the turbulence in the earth atmosphere (using a tip-tilt and a deformable mirror). It corrects up to 60 aberration modes in an isoplanatic patch of about 20 arcseconds.

- **GREGOR** The new 1.5 m solar telescope was commissioned during 2012-2014. I have participated in the commissioning phase in two observing campaigns (10 days each), and also in a polarimetric calibration campaign in 2016. Since then, I have observed at GREGOR for a variety of proposals, both as PI and as an expert who can operate a telescope with 16 mirrors. Not only the AO system of GREGOR is more advanced compared to the VTT, but also a multi-conjugate adaptive optic system is under construction which significantly increase the corrected field of view.

- **Dunn Solar Telescope (DST)** I had five observing proposals at DST, Sacramento Peak (2013-2015), both as service mode and regular observing campaign. The observations consists of near-infrared spectropolarimetry and simultaneous Fabry-Pérot spectropolarimetry in the visible.

- **Interface Region Imaging Spectrograph (IRIS)** Simultaneous co-observation by IRIS satellite was granted during three observing campaigns at VTT and DST in 2014-2015 (23 days). IRIS spectroscopic observations at 140 nm and 280 nm are complementary to ground observations at $\lambda > 380$ nm as different wavelength bands form in different heights in the solar atmosphere.

- **Swedish Solar Telescope (SST)** I had 10 days observing campaign in 2007 at SST as part of an international time program (ITP) in which four ground solar telescopes on Canary Islands along with the Hinode space telescope simultaneously observed a quiet Sun area.

- **THEMIS** I have collaborated in three observing campaigns led by F. Paletou (2006–2008). The French solar telescope THEMIS is a polarization-free telescope which can perform spectropolarimetry at any wavelength in the visible and near-infrared range.

Scientific visits & joint observing campaigns

2017 Locarno solar observatory, Locarno, Switzerland.

2016 GREGOR calibration campaign, Tenerife, Spain.

2015 Coordinated observing campaign, Dunn Solar Telescope, National Solar Observatory, Sunspot, US.

2012 Inauguration of the new 1.5 m GREGOR solar telescope, Tenerife, Spain.

2007 International Time Program 2007. It was a joint project to simultaneously observe the Sun by four ground and one space telescope.

1999 Indian Institure for Astrophysics, Bangalore, India.

Public Outreach

- **1996-1999** Publishing a dozen of popular astronomy articles in the Nojum magazine.
- **2004** Writing an introductory booklet about observational astronomy, Damghan University.

Computer Skills

I have extensively worked with LINUX-based systems, in particular the Debian operating system (since 2006) and Red-Hat Linux through the Fedora project. This includes comprehensive data analysis and data mining, satellite data processing, data management, ... Modern solar facilities have a data rate of about $\approx 1\,\mathrm{TB/h}$ and the data management is a non-trivial task. I have written computer programs in a variety of languages. Since 2007, I write programs mostly in Python.

Languages: Persian, English, German