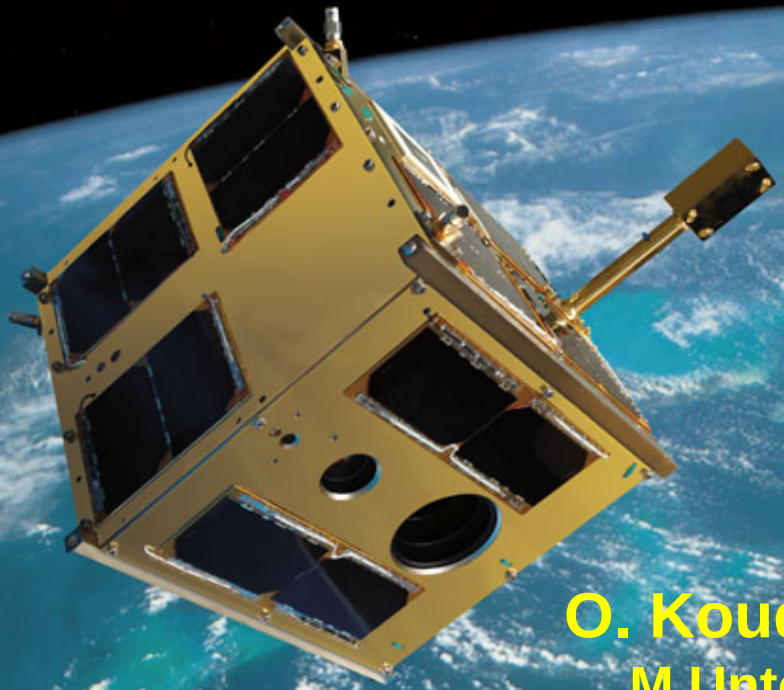
BRITE Nanosatellite Constellation-
Four Years of Successful Operations



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- Introduction
- Scientific goals of BRITE Constellation
- BRITE Charateristics
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BRITE – BRight Target Explorer

World‘s first nanosatellite constellation dedicated to asteroseismology

Country	Satellite Name	ID	Launch	Orbit-P(min)	Filter
AUT	UniBRITE	UBr	2013-02-25	100.37	red
AUT	BRITE-Austria 'TUG-SAT-1'	BAb	2013-02-25	100.36	blue
POL	BRITE-PL2 'Heweliusz'	BHr	2014-08-19	97.10	red
POL	BRITE-PL1 'Lem'	BLb	2013-11-21	99.57	blue
CAN	BRITE-CA1 'Toronto'	BTr	2014-06-19	98.24	red
CAN	*BRITE-CA2 'Montreal'*	*BMb*	*2014-06-19*	*n/a*	*blue*

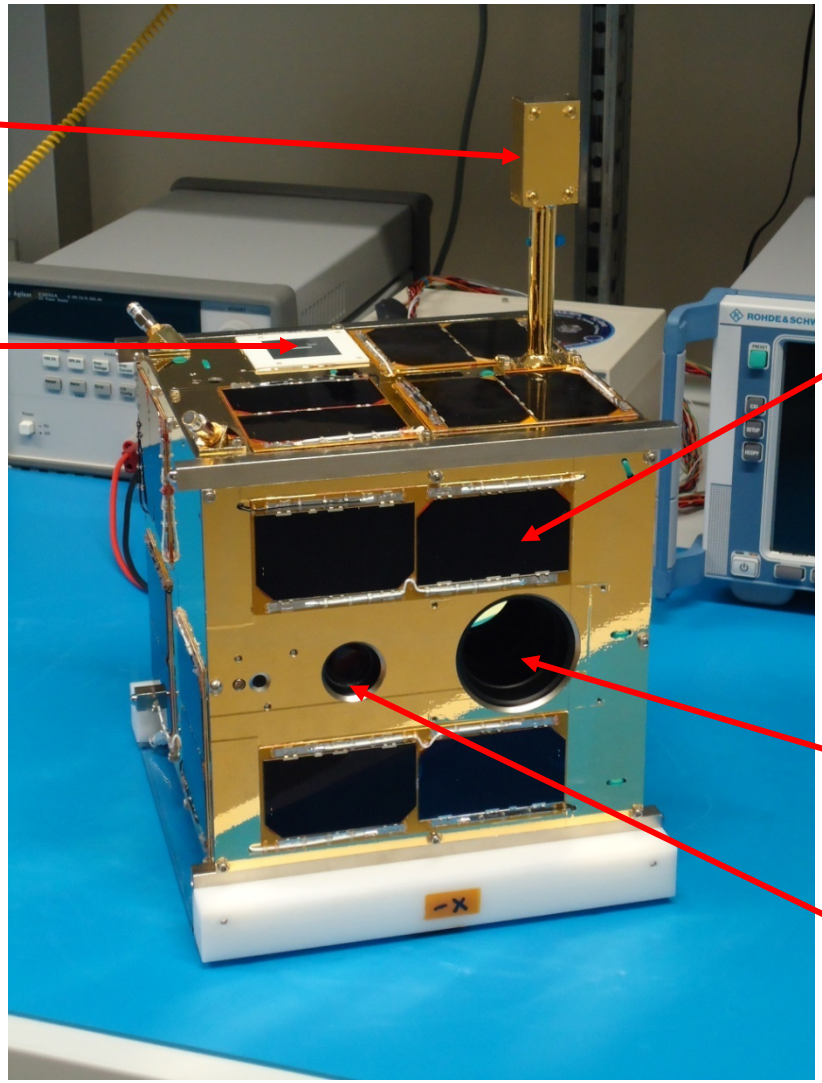
3 countries – 5 (6) satellites – ONE MISSION



Scientific Goal

- Photometric measurement of brightness and temperature variations of massive luminous stars (up to visual magnitude 4)
- Observations: 6 months typ.
- High duty cycle
- 2-colour (blue and red)
- 24° field of view

TUGSAT-1/BRITE-Austria Flight Model

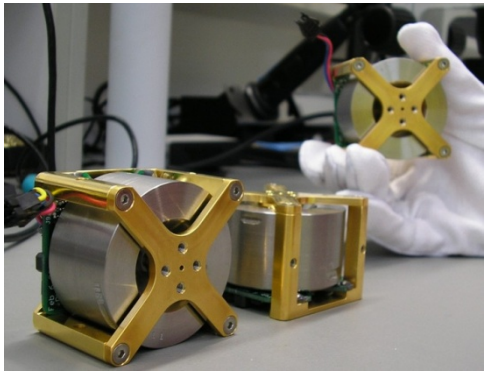


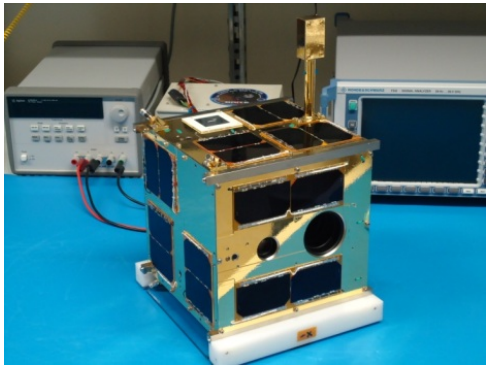
Generic
Nanosatellite
Bus
by

UTIAS SFL
Space Flight Laboratory

BRITE Characteristics

- Nanosatellite: 20 x 20 x 20 cm
- Mass: 7 kg
- Electrical power: 6…11 W
- Transmit power: 0.5 W
- Frequency bands: S-band downlink / UHF uplink
- Data rates: 32…256 kbit/s downlink, 9.6 kbit/s uplink
- Pointing accuracy: 1 arcmin.
- Science data volume: 18…40 MB / day per satellite





Launch

TUGSAT-1/BRITE-Austria and
UniBRITE were launched by
PSLV-C20 of ISRO/ANTRIX
on 25 February 2013
from the Satish Dhawan Space Centre

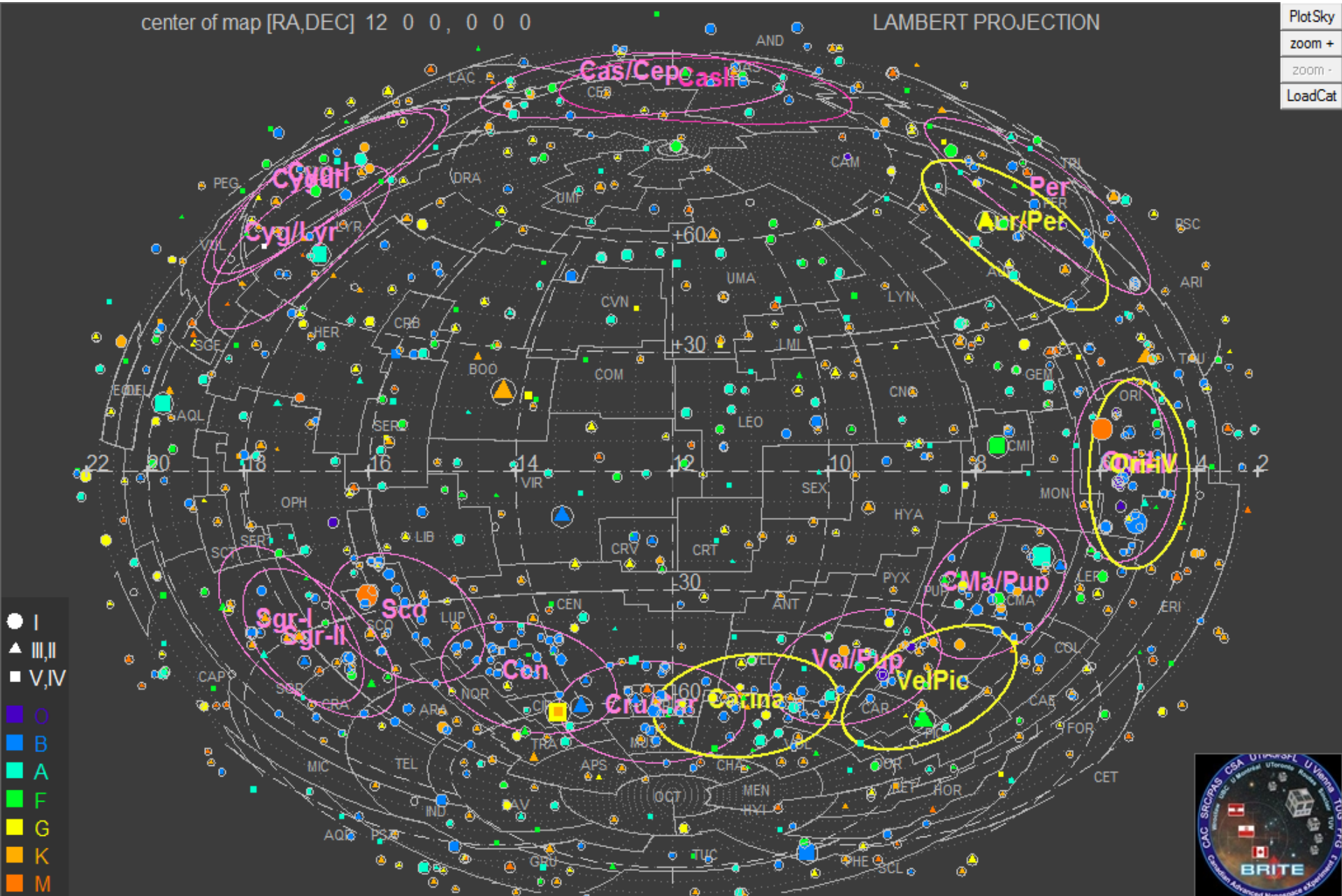
Sun-synchonous LEO orbit

Courtesy: ISRO

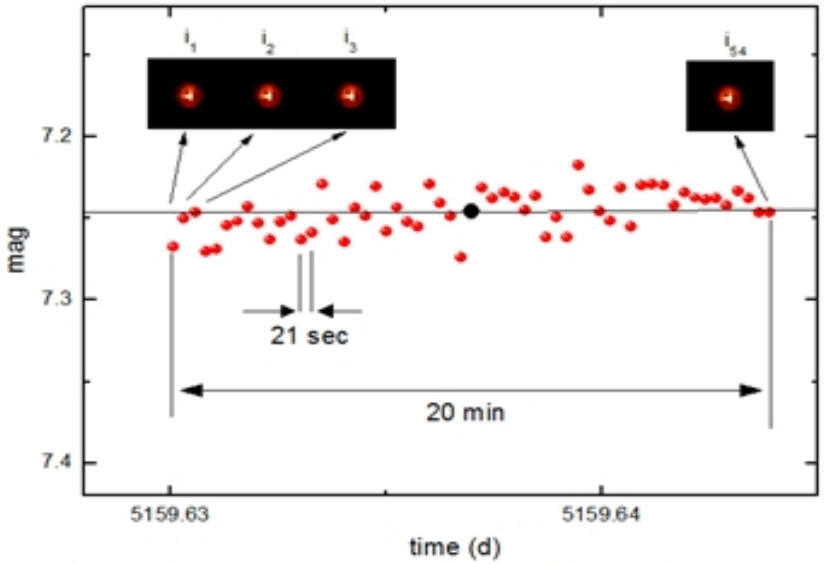
Mission Operations

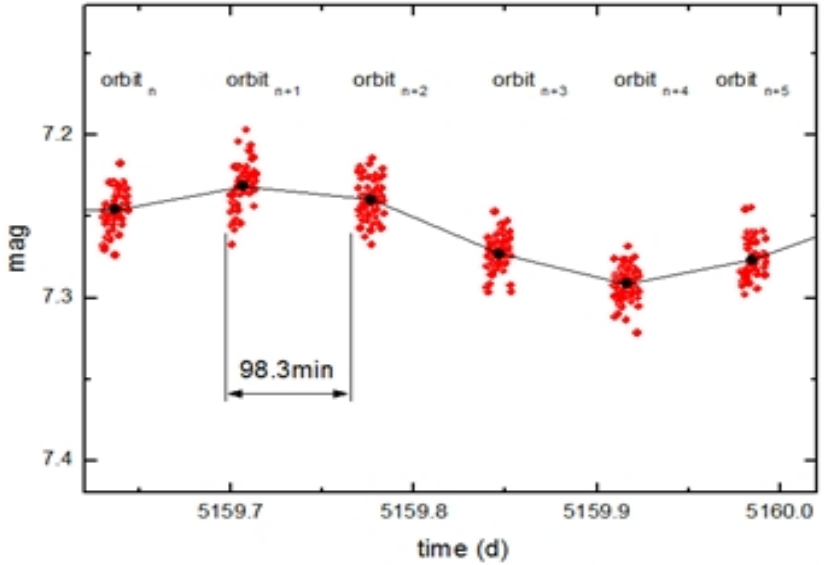
- 14 orbits per day , 6-7 passes per station
- Operations:
- Graz: BRITE-Austria and UniBRITE
- Toronto: BRITE-Toronto
- Warsaw: BRITE-Lem and BRITE-Heweliusz

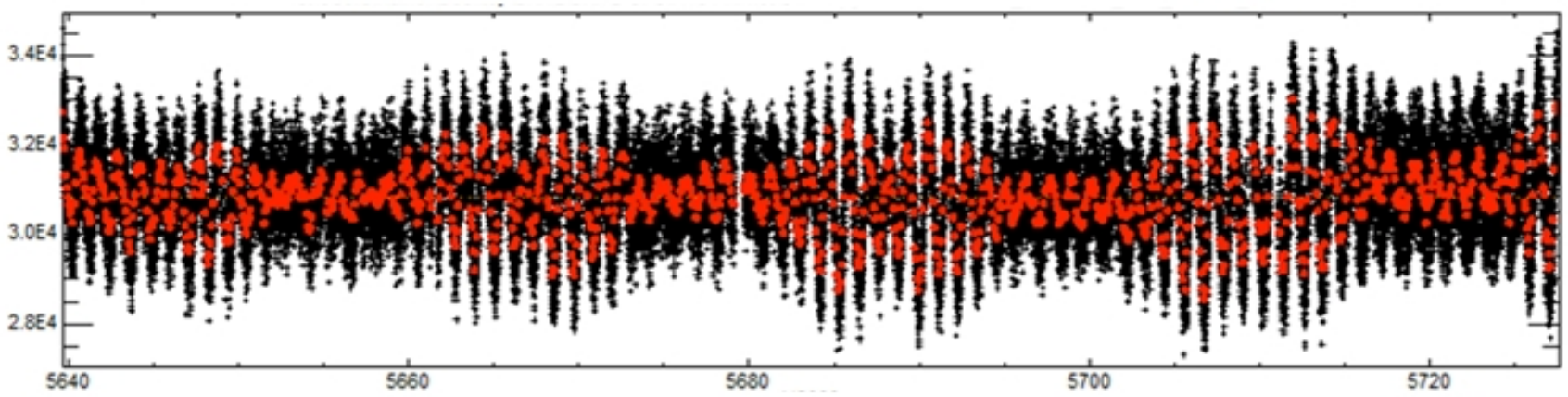
BRITE-Constellation: Observing Fields



BRITE-Constellation: Data Sampling







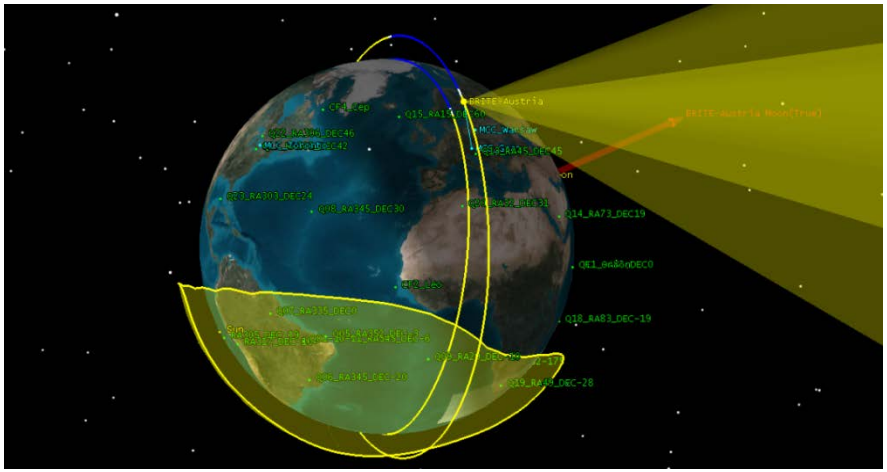
BRITE-Constellation: Observing Fields

#	Field ID	Start Date	End Date	[d]	Status
1	Orion-I_2013	2013-01-12	2014-03-18	108	completed
2	Centaurus_2014	2014-03-25	2014-08-18	147	completed
3	Sagittarius-I_2014	2014-04-29	2014-06-09	42	completed
4	Cygnus-I_2014	2014-06-12	2014-11-25	167	completed
5	Perseus_2014	2014-09-02	2015-02-18	170	completed
6	Orion-II_2014	2014-09-24	2015-03-17	175	completed
7	VelPup_2014(+bet Pic)	2014-12-11	2015-05-28	169	completed
8	Scorpius_2015	2015-02-22	2015-08-31	185	completed
9	Cygnus-II_2015	2015-06-01	2015-11-25	178	completed
10	CasCep_2015	2015-07-23	2016-01-20	149	completed
11	CMaPup_2015	2015-10-18	2016-04-16	180	completed
12	Orion-III_2015	2015-12-12	2016-03-15	95	completed
13	CruCar_2016	2016-01-22	2016-07-22	183	completed
14	Sagittarius-II_2016	2016-04-21	2016-09-23	156	completed
15	CygLyr_2016	2016-04-15	2016-09-23	162	completed
16	AraSco-Test_2016	2016-08-03	2016-09-08	37	completed
17	CassiopeiaII_2016	2016-08-07	2017-02-03	181	completed
18	AurPer_2016	2016-09-10	2017-03-08	180	ongoing
19	Orion-IV_2016	2016-09-08	2017-03-06	180	ongoing
20	VelPic_2016 beta-Pic	2016-11-01	2017-04-29	180	ongoing
21	Carina_2017	2017-01-10	2017-07-08	180	ongoing

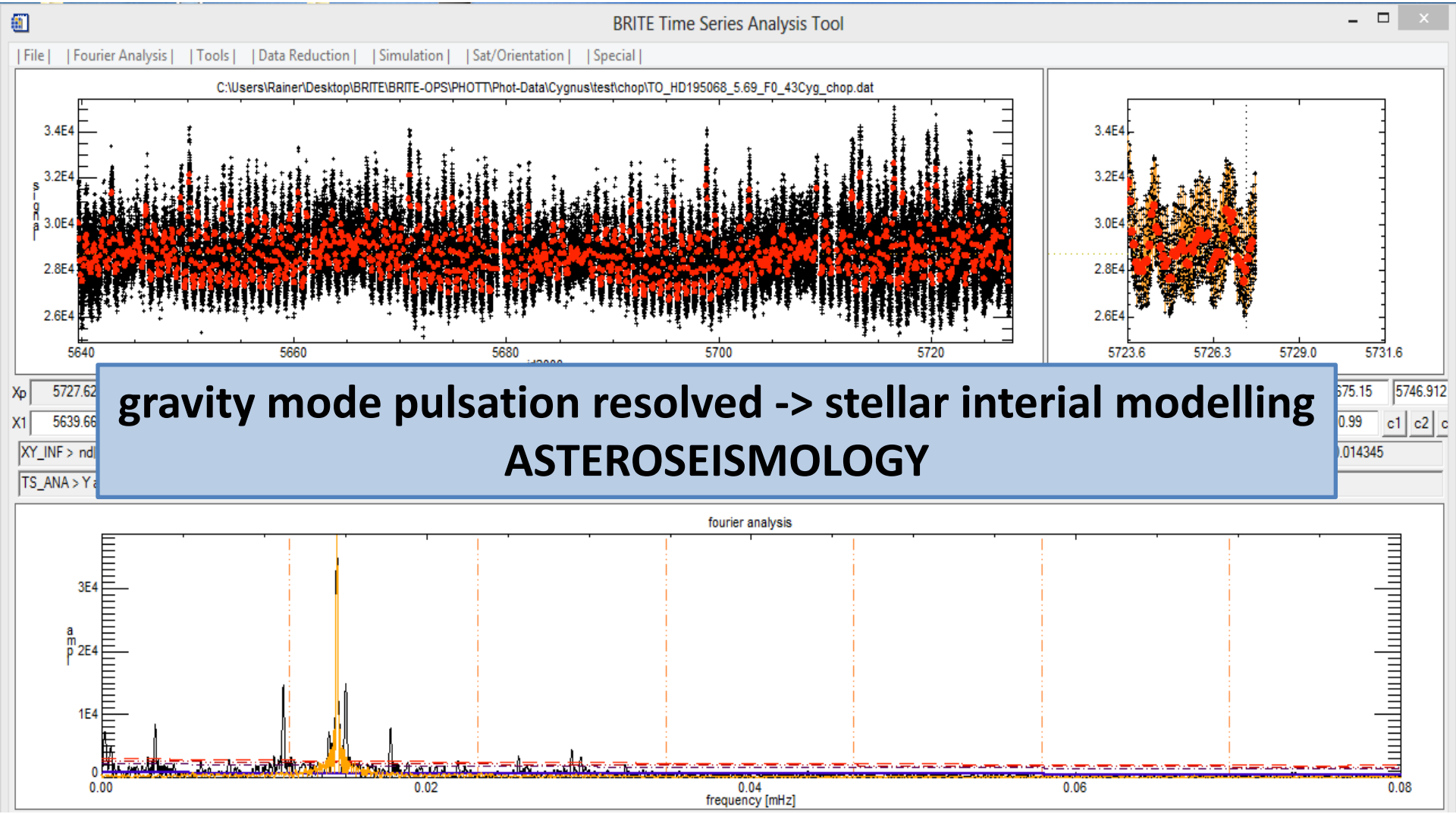
- **17 fields completed**
- **4 fields ongoing**
- **~350 stars observed thus far**
- **14 fields planned till Spring 2019**

Target Selection

- BRITE Executive Science Team (BEST)
- Scientists from Austria, Canada, Poland, Germany, France
- BEST defines targets
- Commands for spacecraft prepared and uploaded by the operations teams



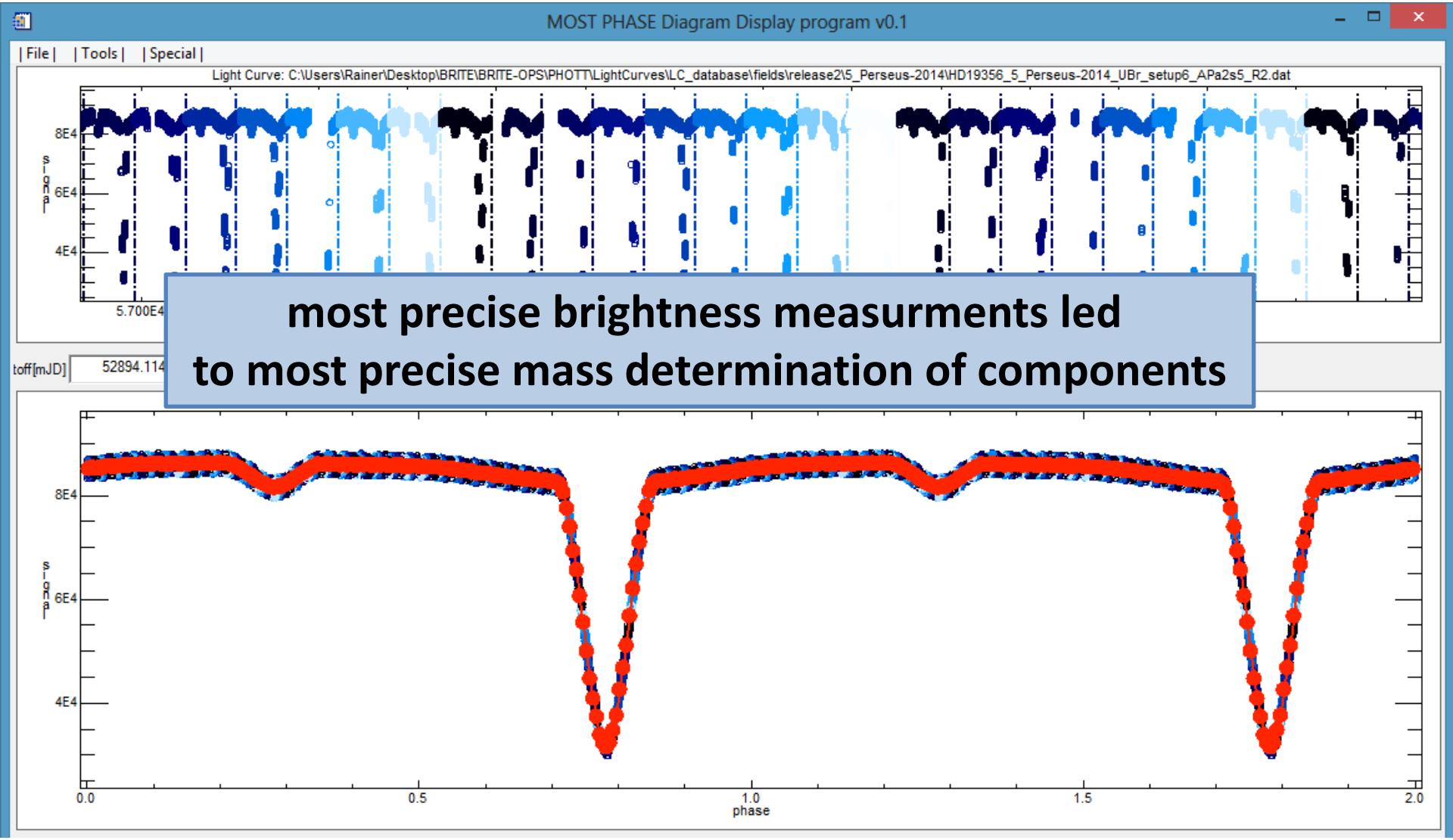
Pulsating star:43 Cyg mag(V)=5.69 F0



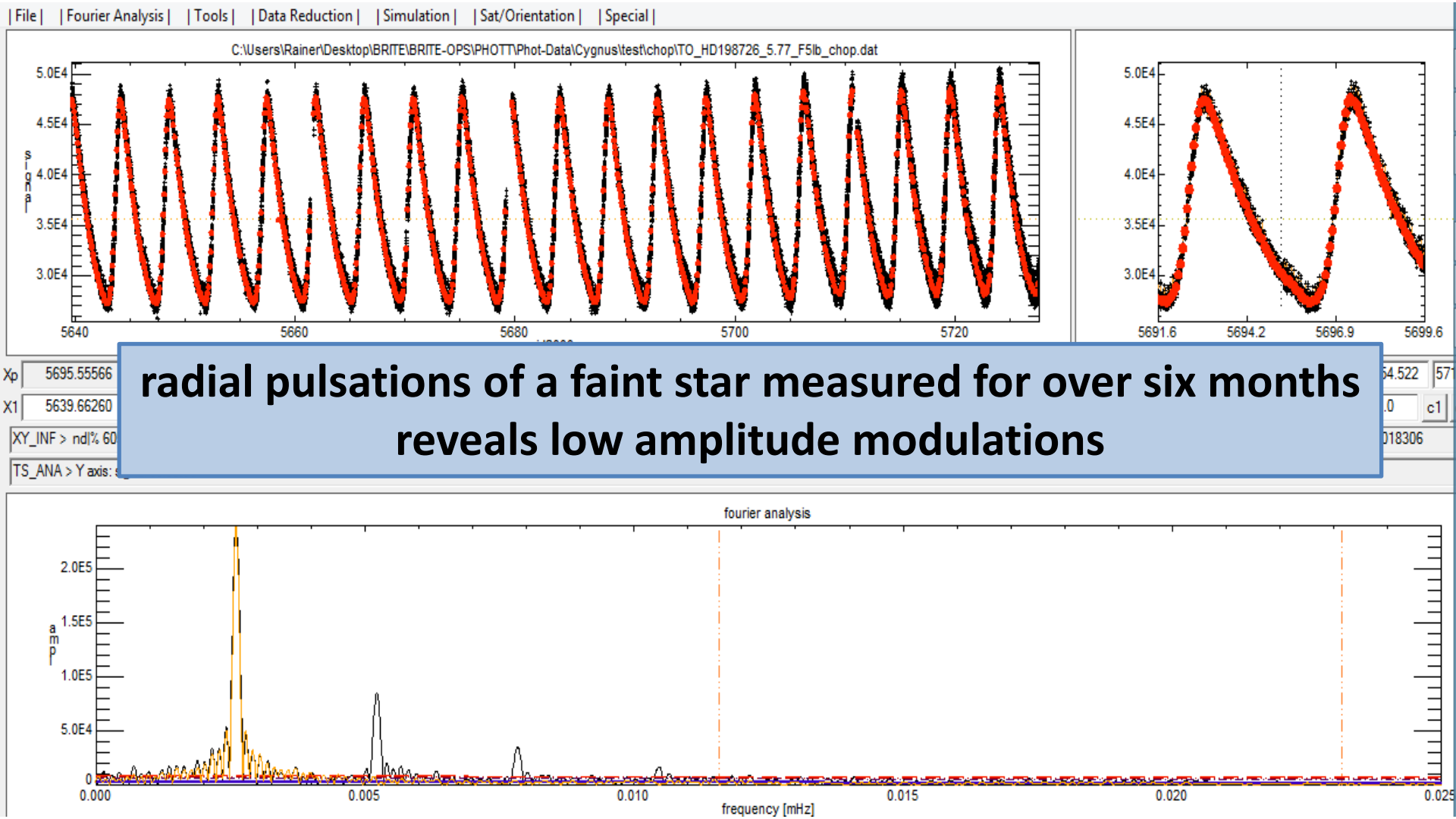
gravity mode pulsation resolved -> stellar interial modelling

ASTEROSEISMOLOGY

Eclipsing binary system: beta Persei - ALGOL

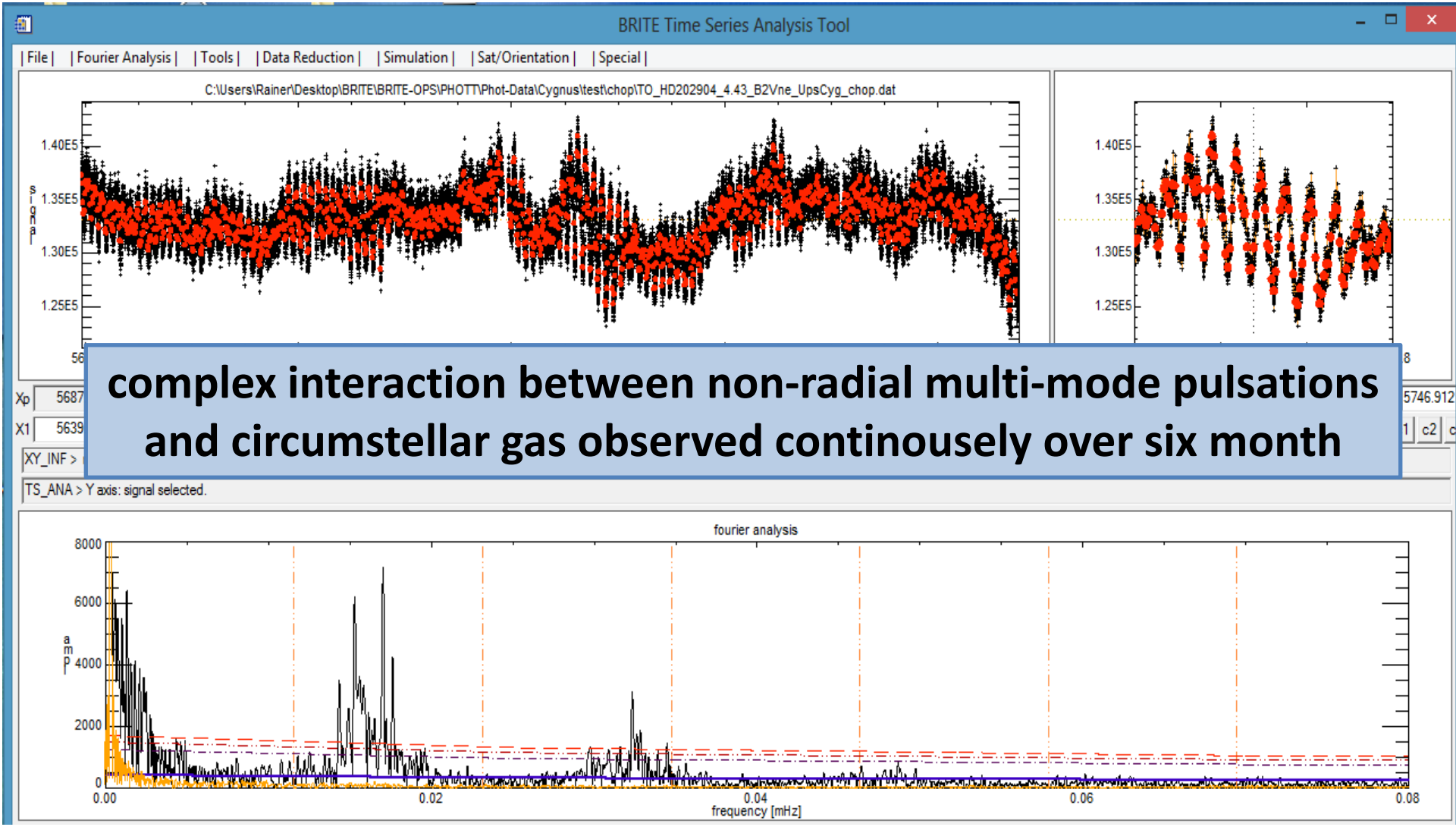


delta Ceph star: T Vul mag(V)=5.77 F5Ib



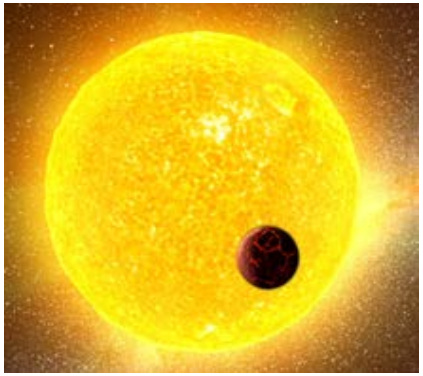
radial pulsations of a faint star measured for over six months reveals low amplitude modulations

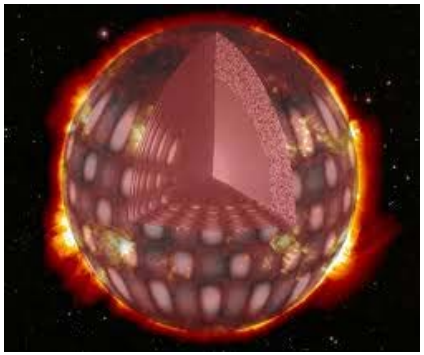
Be (emission line) star: ups Cyg mag(V)=4.42 B2Vne

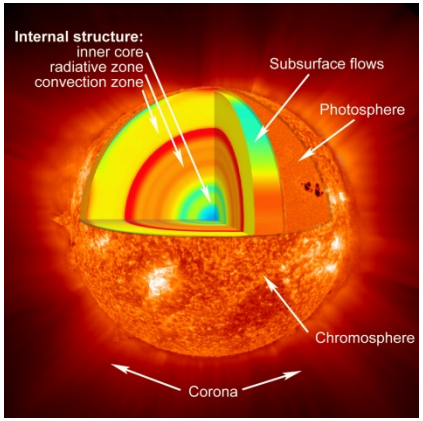


complex interaction between non-radial multi-mode pulsations and circumstellar gas observed continousely over six month

Results from 4 years of TUGSAT-1 and UniBRITE operations as part of BRITE-Constellation:







- comprised the collection of high-presicion brightness measurements (6 months long) for more than 350 stars in two colors
- allowed the detailed investigation of pulsations driven by gravity modes in one of the brightest Slowly Pulsating B star
- enabled the modeling of spots induced rotational variations in the presence of pulsations
- led to a unique study of the ‚heart beat' phenomenon of close interacting binary systems
- **provided unprecedented details of the interaction between stellar pulsations, circumstellar disks and shells**

BRITE Science Conferences

- 2015: Gdansk (Poland)
- 2016: Innsbruck (Austria)
- 2017: Montréal (Canada)

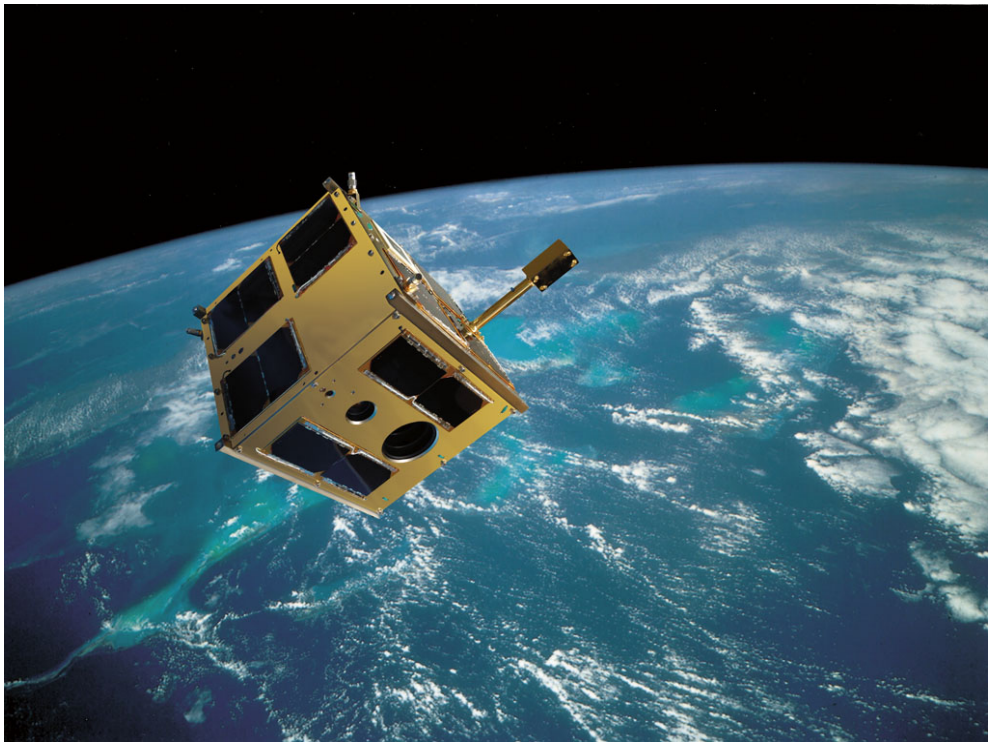
- More than 60 scientists participated

Status Summary and Outlook

- BRITE-Constellation is operating since Feb. 2013
- 5 satellites including BRITE-Austria and UniBRITE are collecting data every day
- ~350 stars in 21 campaigns observed
- more than 2.5 million images have been collected ... and counting
- 12 peer reviewed publications to date and a current rate of ~1 submission per month
- Excellent health status of all 5 spacecraft
- Expect at least 2 more years of high quality data
- The future is BRITE!




Results are based on data collected by the BRITE Constellation satellite mission, designed, built, launched, operated and supported by the Austrian Research Promotion Agency (FFG), the University of Vienna, the Graz University of Technology, the Canadian Space Agency (CSA), the University of Toronto Institute for Aerospace Studies (UTIAS), the Foundation for Polish Science & Technology (FNiTP MNiSW), and National Science Centre (NCN)



Thank you for your attention!