Univerza v Novi Gorici
Fakulteta za naravoslovje

University of Nova Gorica
School of Science

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Astrofizika zvezd I
Course name:	Stelar astrophysics I

Študijski program in stopnja **Study program and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Fizika in Astrofizika I. stopnja	/	2	1
Physics and Astrophysics I. level	/	2	1

Vrsta predmeta / Course type	obvezni / mandatory
Univerzitetna koda predmeta / University course code:	1FAF10

Predavanja **Lectures**	**Seminar** **Seminar**	**Sem. vaje** **Tutorial**	**Lab. vaje** **Lab. work**	**Teren. vaje** **Field work**	**Samost. delo** **Indiv. work**	**ECTS**
30	/	30	/	/	120	6

Nosilec predmeta / Lecturer:	Doc. dr. Tanja Petrushevska	
Jeziki / Languages:	**Predavanja / Lectures:**	English
	Vaje / Tutorial:	English

Pogoji za opravljanje študijskih obveznosti:	**Prerequisits:**
/	/

Vsebina:	**Syllabus outline:**
1. Opazovalne lastnosti zvezd, HR diagram in klasifikacija. 2. Osnovni fizikalni opis zvezd: hidrostatično ravnovesje, enačbe stanja, virialni teorem, politropni modeli in enačba Lane Emden, termično ravnovesje, proizvodnja energije in energijsko ravnovesje, prenos energije s sevanjem in konvekcijo, karakteristični časi zvezd. 3. Nastanek zvezd: Jeansova masa, faze kolapsa oblaka, protozvezde in vstop na glavno vejo HR diagrama 4. Lastnosti zvezd na glavni veji HR	1. Observational properties of stars, HR diagram and the classification of stars. 2. Basic physical description of stellar structure: hydrostatic equilibrium, equation of state, virial theorem, polytropic models and Lane Emden equation, thermal equilibrium, energy production and equilibrium, energy transport with radiation and convection, characteristic time-scales. 3. Stellar formation: Jeans mass, cloud collapse phases, protostars and entrance on the main sequence of the HR diagram. 4. Properties of stars on the main sequence of

diagrama. 5. Razvoj zvezd po glavni veji HR diagrama, vžig helija, višje stopnje gorenja, eksplozija supernove. 6. Kočna stanja razvoja zvezd. 7. Spremenljive zvezde, dvojne zvezde. 8. Razsute in kroglaste kopice. 9. Metode določanja oddaljenosti zvezd	the HR diagram. 5. Evolution of stars after the main sequence of the HR diagram, helium ignition, higher cycles of nuclear burning, supernova explosion. 6. Final stages of stellar evolution. 7. Variable stars, binary stars. 8. Open and globular stellar clusters. 9. Methods for stellar distance determination.

Temeljni literatura in viri / Basic readings:
1. Introduction to Stellar Astrophysics - LeBlanck (2010) 2. An Introduction to the Theory of Stellar Structure and Evolution (2nd Edition) - Dina Prialnik (2010) 3. An Introduction to Modern Astrophysics (2nd Edition) - Caroll and Ostlie (2017)

Cilji in kompetence:	**Objectives and competences:**
	- Basic knowledge of stellar properties and evolution;

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študenti bodo osvojili pojme in koncepte:	Students will learn: - stellar properties and classifications - energy generation and transfer within the stars - properties and dynamics of star clusters At the end of the course students should have gained enough knowledge to follow the course on Stellar Astrophysics II.

Metode poučevanja in učenja:	**Learning and teaching methods:**
- predavanja - računske vaje	- lectures - tutorials

Načini ocenjevanja:	**Utež / Weight (%)**	**Assessment:**
- kolokviji, pisni izpit	50	- written tests, writen exam

- ustni izpit	50	- oral exam

Reference nosilca / references of the course principal:

Dr. Tanja Petrushevska je docentka za področje fizika na Univerzi v Novi Gorici.

Dr. Tanja Petrushevska is an assistant professor of physics at the University of Nova Gorica. Her research interests lie in the field of observational astrophysics and cosmology, especially time domain astronomy. Her research has showed the feasibility of searches for strongly lensed supernovae with ground-based facilities and resulted in the discovery of five of the most distant core-collapse supernovae with implications on the volumetric core-collapse rates to very high redshifts. It has furthermore showed the utility of supernovae for cosmological studies, by investigating the properties of the strongly lensed and very distant supernova. As part of the intermediate Palomar Transient Factory, she has contributed to the discovery of supernovae and their study, including the first resolved, multiply-imaged supernova Ia and the first supernova forming a compact neutron star binary. Her current research also includes studying tidal disruption flares and searching for short gamma-ray bursts from supernovae induced by axion-like particles which are candidates for dark matter.

Selected publications:

1. *High-redshift supernova rates measured with the gravitational telescope A1689.* T. Petrushevska, R. Amanullah, A. Goobar, S. Fabbro, J. Johansson, T. Kjellsson, C. Lidman, K. Paech, J. Richard, H. Dahle, R. Ferretti, J. P. Kneib, M. Limousin, J. Nordin and V. Stanishev, A&A, Volume 594, A54, 21 pp, (2016).

2. *Testing for redshift evolution of Type Ia supernovae using the strongly lensed PS1- 10afx at z = 1.4*. T. Petrushevska, R. Amanullah, M. Bulla, M. Kromer, R. Ferretti, A. Goobar and S. Papadogiannakis. A&A, vol. 603, A136, (2017).

3. *iPTF16geu: A multiply-imaged gravitationally lensed Type Ia supernova.* A. Goobar, 30 additional authors including T. Petrushevska, Science, vol. 356, 6335, 291-295 (2017).

4. *Searching for supernovae in the multiply-imaged galaxies behind the gravitational telescope A370*. T. Petrushevska, D. J. Lagattuta, R. Amanullah, A. Goobar, L. Hangard, S. Fabbro, C. Lidman, K. Paech, J. Richard, and J. P. Kneib, A&A vol. 614, A103, (2018)

5. *A hot and fast ultra-stripped supernova that likely formed a compact neutron star binary* K. De, 25 additional authors including T. Petrushevska, Science, vol. 362, 6411, (2018).

6. *Prospects for observing strongly lensed supernovae behind Hubble Frontier Fields galaxy clusters with the James Webb Space Telescope*. T. Petrushevska, T. Okamura, R. Kawamata, L. Hangard, G. Mahler and A. Goobar, Astronomy Reports, vol. 62, 12, (2018).