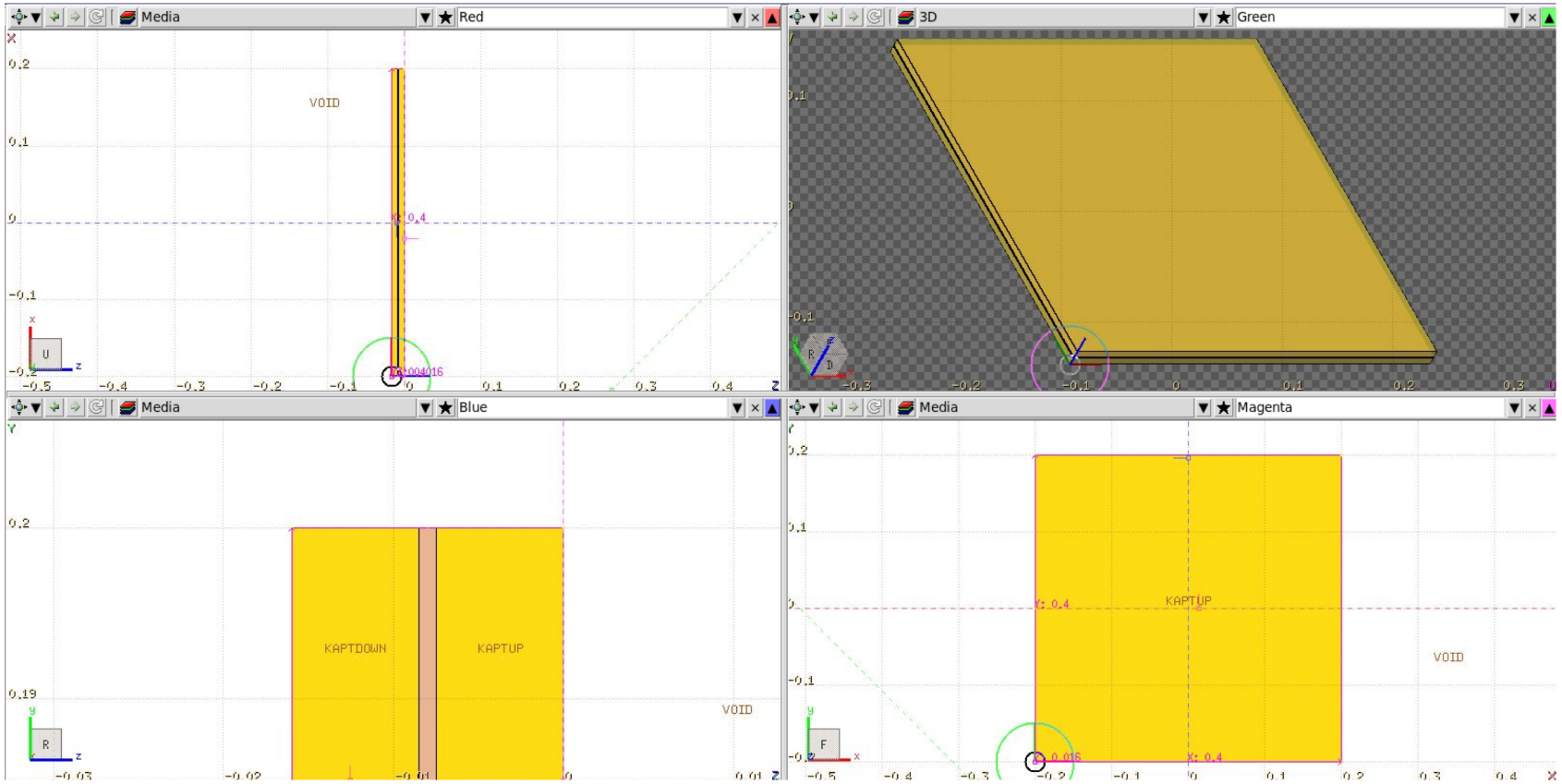
WG5 Fi-Ub: October 4, 2022 update

- Preparation of the paper in progress (LS&CG)
- Preparation of the ASI proposal in progress (HASPIDE Coll.+ S. Perri)
- SEP detector (one-unit detector geometry: 4x4 mm^2 silicon wafer 10 μm and two layers 75 μm)



From M. Fabi


MAGNETARS FOR
SPACE WEATHER

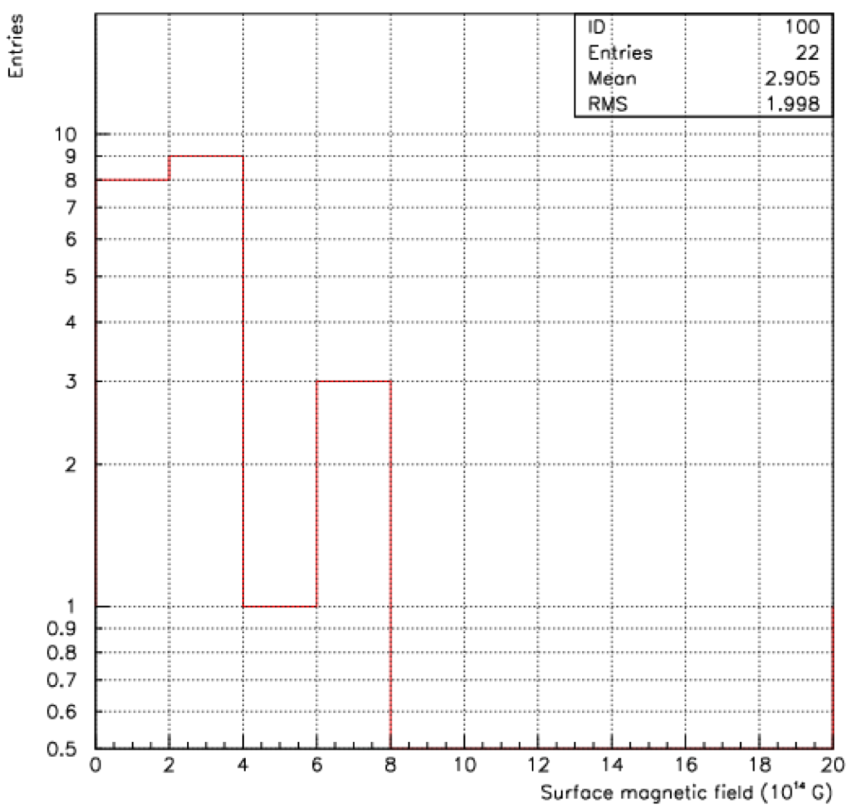
SGRs and AXPs

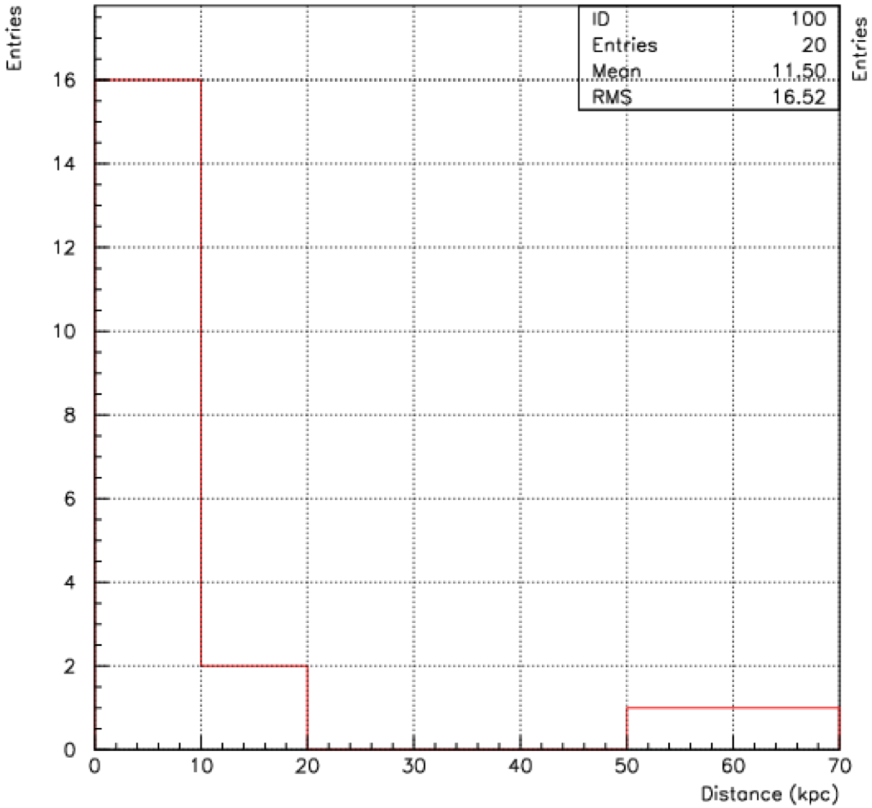
- **Hard X rays and soft gamma rays associated with GRBs (we focus here on magnetar flaring only since many of them are galactic) allow for increasing the ionization of ionosphere thus disturbing VLF in the range 3-30 kHz – ozone layer depletion**
- 31 magnetars listed in the **McGill Online Magnetar Catalog**
- **(https://www.physics.mcgill.ca/~pulsar/magnetar/main.html)** di cui 7 da confermare (6+ PSR J1846−0258)
- SGRs and AXPs are believed to be magnetars
- 12 SGRs + 4 candidates
- 12 AXPs + 2 candidates
- Pulsars and magnetars have blackbody temperatures that lie in the X-ray band: a continuous emission arrives from these stars
- In addition flaring from these compact objects is observed
- **Soviet probes Venera 11, Venera 12 and the German-American solar satellite Helios II all are hit by "off the scale" gamma rays leading to the discovery of soft gamma repeaters**
- The first giant event was observed from the Large Magellanic Cloud at 55 kpc
- **The majority of certain magnetars lie within 10 kpc**
- **Basically all of them lie present surface magnetic fields between**
- **10^{13}-10^{15} G**
- **Periods are of the order of 1–10 s**
- **$\sim 1.5–3 \times 10^{-3}$ yr^{-1} for the magnetar birthrate**
- **Progenitor mass 20-45 solar masses**
- **Mass: 1.4-1.6 solar masses**

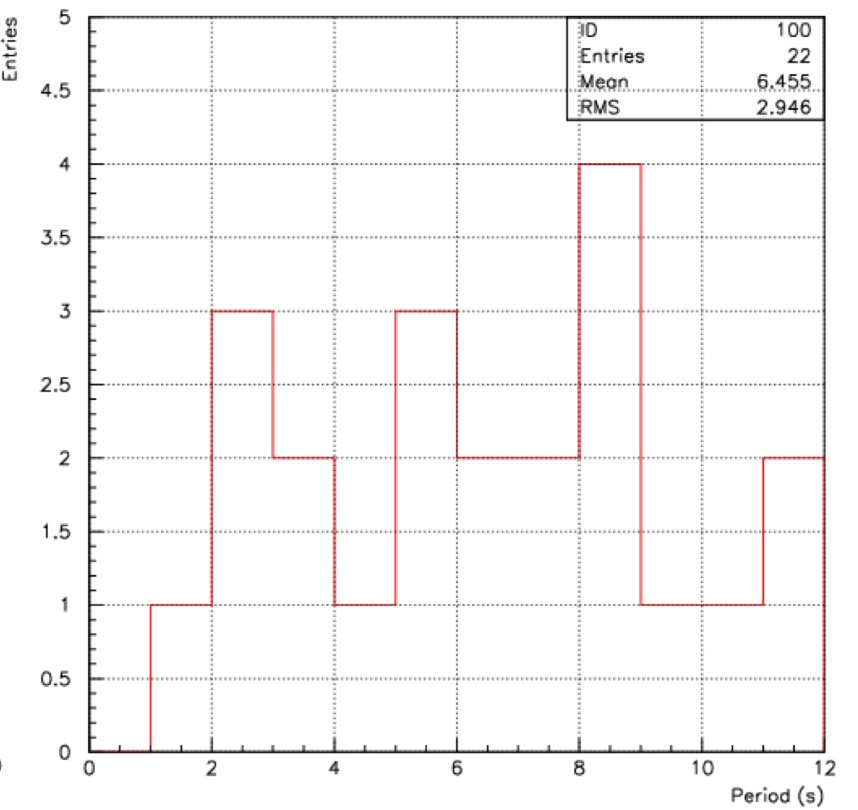
Olausen & Kaspi, 2014

Properties of magnetar

Courtesy of M. Fabi

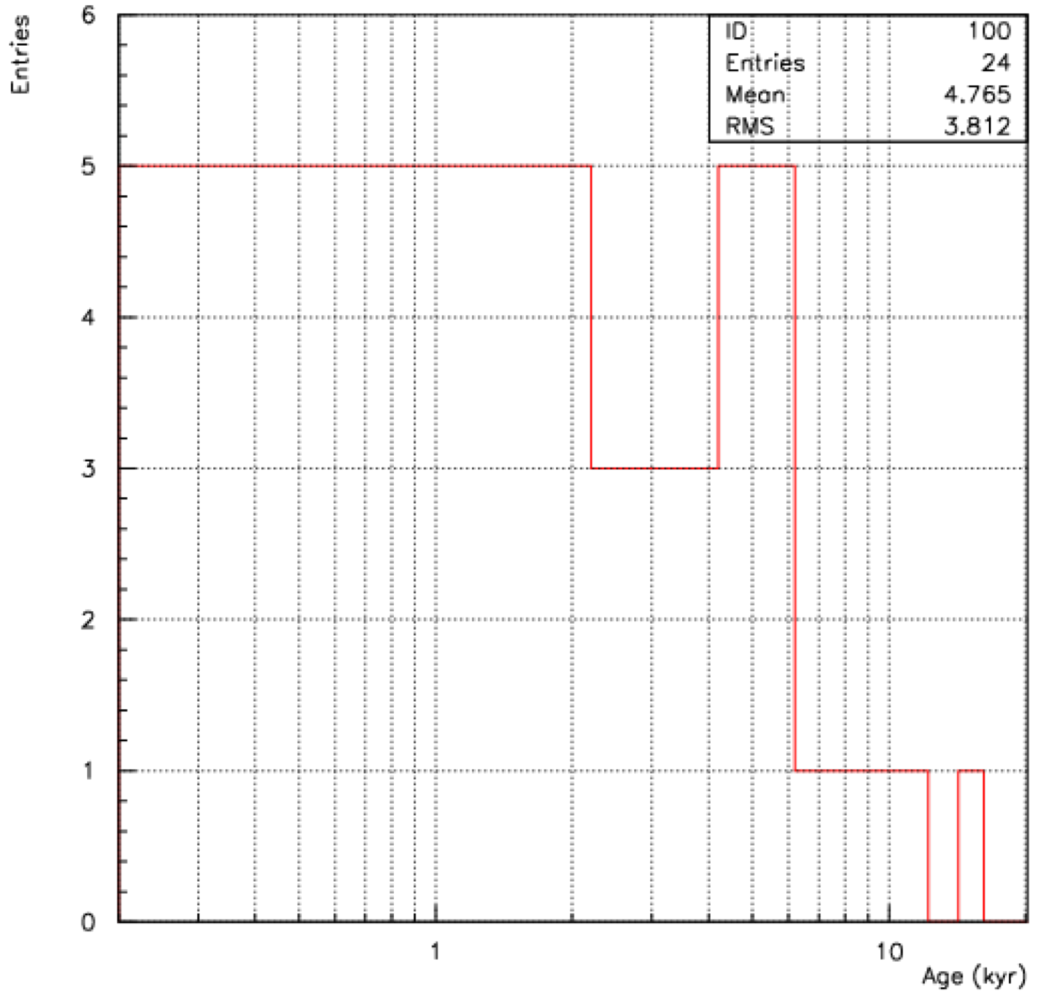






Olausen & Kaspi, 2014 **https://www.physics.mcgill.ca/~pulsar/magnetar/main.html**

Magnetar age



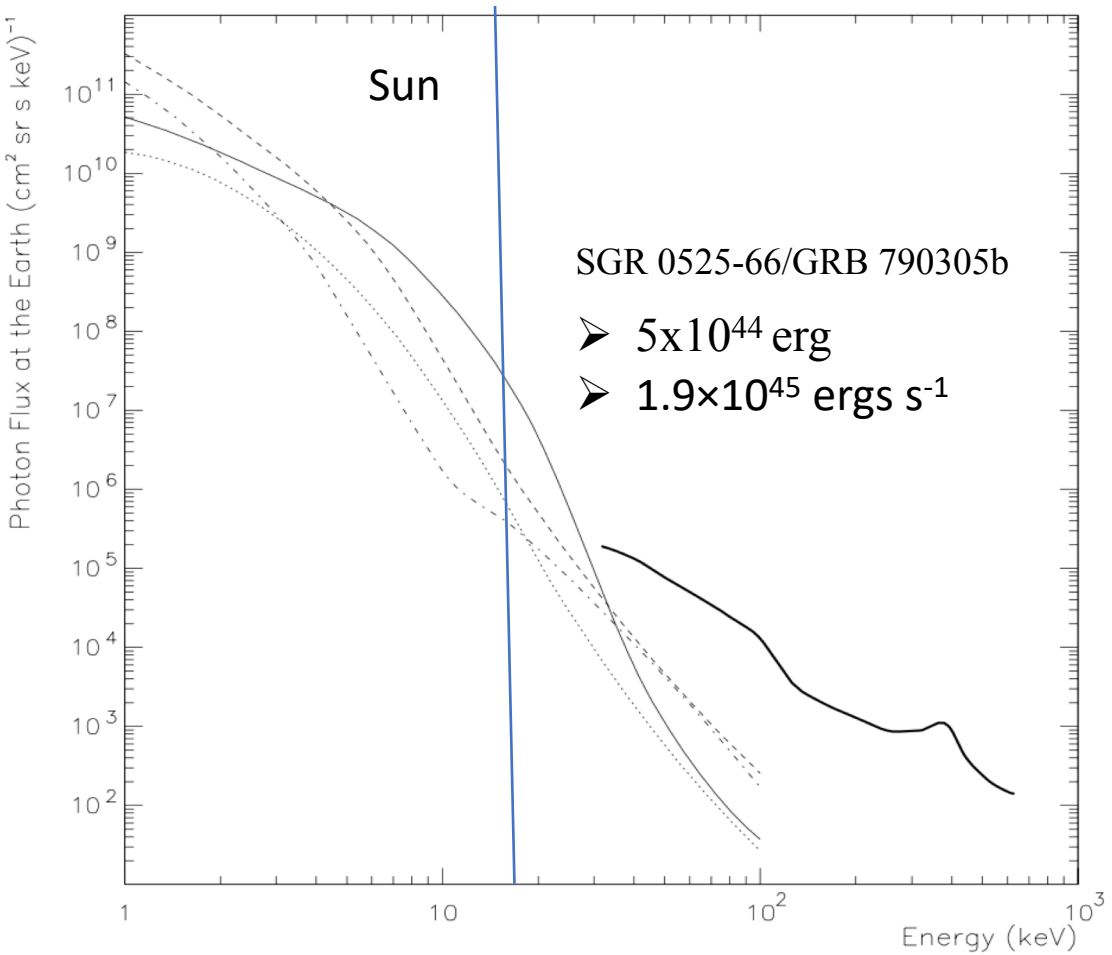
Other characteristics of magnetars

- Continuous X-ray emission characterized by a few second periodicities and a luminosity of 10^{35}-10^{36} erg s^{-1} in the range 1-200 keV.
- Flaring 0.1-1 s (first phase 0.2 s)
- In general magnetar emit 10^{39}-10^{42} erg s^{-1} even though the emission may reach 10^{44} erg s^{-1} and the total energy vary between 10^{44} a 10^{46} erg
- These emissions are weak with respect to extragalactic GRBs (> 10^{51} erg)

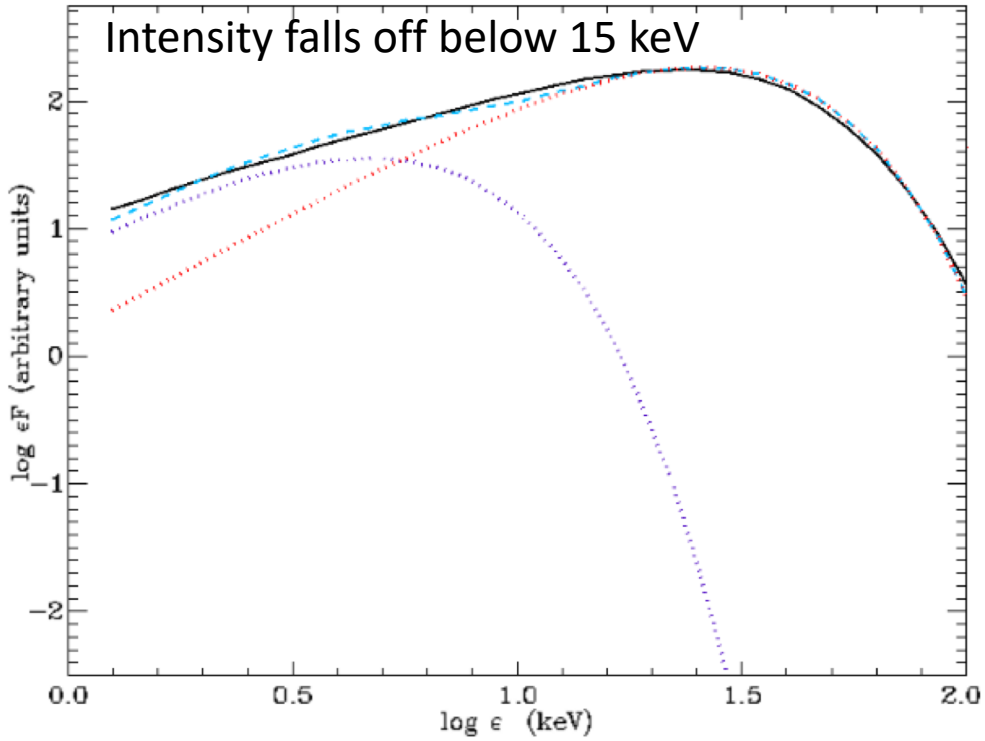
Fallback discs surrounding magnetars and pulsars

- The evolution of these compact objects MAY be affected by surrounding discs (CG, MNRAS, 2018, 2021). However…
- A recent study has shown that out of a sample of 800 pulsars very few candidates of disc presence are there
- This is not the case for magnetars: 4U 0142+61 (3.59×10^{6} K – 0.309 keV) disc of 10 Earth masses, 2.02×10^{9} m – 6.75×10^{9} m – 920 K
- This may be ascribable to larger angular momenta of fallback material for magnetars with respect to pulsars. As a result, despite discs around pulsars and magnetars are one of the theories to explain SGR and AXP formation, we believe that it goes on the opposite direction even though the presence of discs may affect magnetar spin down in addition to em energy losses and the disc presence may affect the electron and positron propagation in the magnetar near environment.

Comparison of near-Earth X solar flaring to the March 5th event @ 1 kpc distance



Fenimore, Klebesadel and Laros, ApJ, 460, 964, 1996



Roberto Taverna & Roberto Turolla, Galaxies, 6, 35, 2018

WE MAY BE ABLE TO MONITOR THESE EVENTS WITH **HASPIDE-SPACE**

Some other events

- SGR 1900+14 : August 27, 1998 at 12.5 kpc from Earth, total hard X-ray and soft gamma emission of $2x10^{44}$ erg.
- SGR 1806-20 at 8.7 kpc from Earth was observed on 27 dicembre 2004.
- **Up to 10^{47} erg are expected. The duration is: peak emission < 1 s; tail up to hundreds- one thousand seconds. Afterglow hours for extragalactic GRBs.**
- **Energy most likely beamed**

References

- C. Grimani, MNRAS, 2021
- Fenimore, Klebesadel and Laros, ApJ, 460, 964, 1996
- Lilia Ferrario, Dayal Wickramasinghe, MNRAS, *Monthly Notices of the Royal Astronomical Society: Letters*, Volume 389, Issue 1, September 2008, Pages L66–L70, https://doi.org/10.1111/j.1745-3933.2008.00527.x
- Roberto Taverna & Roberto Turolla, Galaxies, 6, 35, 2018