Spectroscopic data exploitation

A. Vallenari & S. Randich

INAF, Padova

- What do we need to maximize the scientific return?
- Scientific priorities
- Opportunities(strength)
- Critical points (weaknesses)
- Actions

➔ A White Paper

Instruments

- Large spectroscopic surveys (+Gaia) : data and PI time
  - **4MOST call for 30% of open time survey (mid-2019):** ready by 2023
  - WEAVE 30% PI time
  - MOONS @VLT -1000 targets on 500 arcmin2, H=15-16

- Larger telescopes
  - MSE (11m) Mauna Kea
  - E-ELT MOS(I=24 -- I=27 R=1000 – 20,000?) LG galaxies
  - E_ELT MIDIR- HIRES (R=100,000 at R=21)
- IR Facilities
  - Now: CARMENES, IGRINS, GIANO/GIARPS, APOGEE
  - Future: CRIRES+(VLT), SPIROU (CFHT) and NIRPS, E-ELT(HIRES), JWST(NIRSpec-100 target R=1000), MOONS

Science cases

The Galaxy: Formation and evolution of sub-galactic structures→Large spectroscopic surveys (+Gaia)

- Formation
- Dark matter
- Metal poor stars
- Clusters vs field (halo and disk)
- Star formation

- **From the Galaxy to galaxies** Larger telescopes :, LBT, VLT,MSE, E-ELT MOS(I=24 -- I=27 R=1000 – 20,000?)
  - As MW building blocks
  - SF and chemical enrichment
  - Extragalactic clusters
  - Is the MW the paradigm of galaxy formation?

- **Star formation**
  - Global vs local star formation
  - Planetary formation

- **Exoplanets**
  - Planetary system characterization (mass, radius separation)
  - Relation between exoplanets and their star properties
  - Atmosphere characterization (IR)

- **Stellar evolution**
  - Mixing in stellar interiors
  - Mass loss
  - Young stars

- Opportunities:
  - Synergies with photometric surveys & space missions
  - LSST (2022+)– spectroscopic follow-up(planets, transients, 3D map) & calibration
  - TESS, PLATO (2024+)→ asteroseismology→Galactic Archeology
    - Follow-up exoplanets characterization
  - CHEOPS…ARIEL → exoplanets
  - JWST (2020+), WFIRST (2020+??), ATLAST(2025++), EUCLID(2020)

- **Critical points (weaknesses)**
  - Lack of coordination/man power
    - Lack of theoretical tools
      - Stellar modelling/galactic chemodynamics/asteroseismology
      - Sophisticated statistical tool for Big Data analysis
    - Archives
    - data mining and, in general methods and tools for the scientific exploitation

- **Actions**
  - Coordination/collaboration/synergies for a better exploitation between different groups
    - Inter-survey/project/calibrations
    - Free access common Tools
    - Common Data processing facilities
    - Archiving facilities