Big Science Questions in RU-D

- How did galaxy structure evolve and how is the visible Universe connected to the dark?
- Is our Milky Way special?
- How do stars form and how were galaxies enriched with heavy elements?
- Which conditions lead to the formation of our Solar System or habitable systems in general?

Current research topics in RU-D in ORIGINS

RU-D.1: Galaxies in transition to extreme environments
Dolag, Finoguenov, **Mohr**, Springel, Strazzullo

RU-D.2: Formation and evolution of galaxies at the peak epoch of cosmic star formation
Burkert, Genzel, Naab, Springel

RU-D.3.1: The evolution of the Milky Way in the Gaia era, and the birth place of the Sun
Burkert, Emsellem, Enßlin, Gerhard, **Janka**, Naab, Springel, Valenti

RU-D.3.2: Decoding the chemical evolution of star-forming galaxies over cosmic time
Burkert, Cirasuolo, Dolag, Genzel, Gerhard, **Janka,** Kudritzki, Naab, Romaniello, Springel, Weiß

RU-D.4: Understanding the physics of star formation
Burkert, **Caselli**, Cirasuolo, Emsellem, **Ercolano**, Ivison, Kudritzki, Naab, Preibisch, Romaniello, Testi, van Dishoeck

RU-D.5: Formation and characterisation of planetary systems and their atmospheres
Bender, Birnstiel, **Braun**, **Ercolano**, Fabricius, Grupp, Kissler-Patig, Pasquini, Saglia, Testi, van Dishoeck

RU-D.6: The Cosmological ORIGINS Simulation Project
Burkert, Dolag, Naab, Springel

Which aspects of ORIGINS worked well and what were the highlights for you?

- **Common events generally always very interesting:**
  Research Days of RU-D/C, Science Week, Axion Day, etc.

- **People in the local research environment are brought together by ORIGINS**
  new collaborations fostered, sense of community created, helps in attracting people to Munich

- **Good interactions between RU-C and RU-D** (synergies with connectors still underused, despite huge potential in principal… particularly to CN-1: Black holes, CN-2: Planets & other Habitats, CN-3: Properties of dark matter, CN-5: Turbulence)

- **Plenty of interesting results and papers produced**

- **When young people are put in charge, things worked out well**
  (e.g. three ORIGINS postdocs were asked to organize a RU-D day that went very well)

- **Cluster administration always very helpful, supportive, and efficient**

- **Seed money and visitor program great** (but costs lots of research board time)

Are there any aspects that need improving? What are your suggestions?

- Apparently, the **original milestones** are emphasized very strongly (**sigh**) by the SAC and the DFG… But then the mechanisms in place to enforce progress towards them seem insufficient.

- **The RU-X and CN-X need to meet much more often,** and **much more regularly.** They should all have at least a monthly meeting, for example a regular telecon every 4 weeks in which steady progress towards common milestones is arranged. The telecon schedule should be organized cluster-wide centrally, and be transparent for all cluster members.

- Difficult to find internal information about current research progress of RU-X/CN-X. Would be good to have minutes for the above meetings (produced on the spot), and **have this all collected on a central platform** accessible by all ORIGINS members (e.g. google docs)

- **Do not make overworked senior people (like me) research unit coordinators.** They are useless – find young people with drive and energy to do it.

- I feel I have spent more time in administration-oriented meetings in ORIGINS than in meetings for organizing science… Would be good to **discuss more about science in the research board** and less about nitpicking details, like which visitors to approve, etc.

Are there new directions or missing expertise that should be established?

- **JWST** provides exiting data about the birth cradle of galaxies. The **formation of the earliest generation of galaxies** is a new hot topic.

- The imminent advent of **exascale computers** in Germany in principle enables addressing computational great challenge problems in RU-D, in particular multi-physics, multi-scale simulations. We do not have enough expertise at the moment to **port our simulation codes to GPUs**. We for sure don't have the required **man power.**

- The **formation of dwarf galaxies** is a very timely research topic that is not explicitly covered in RU-D. It is connected to small-scale challenges (cusp/core issue). Dwarfs are also the systems in which the best chance exists to **directly resolve the ISM in a fully cosmological setting**.