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\*Typical beam time at LNL > 6 months

# Key considered configurations





# Expected more than $1\pi \rightarrow$ more than 10% eff in singles





# State-of -the-art setups





## Stable beams

- AGATA workshop @ LNL, 25-26 March 2019:
- 60 LoIs in total.
- I1 Lol considering segmented Si detectors (i.e. TRACE/MUGAST/GRIT). Similar number for EUCLIDES (FE reactions).
- Reaction mechanism: (in)el scattering, fusion, transfer...
- Case by case evaluation in terms of Si setup.

# Physics: several ideas and more could come

- Cluster and molecular states (Li,t)
- $\gamma$  branch from near-threshold states [Be, C, Li and B..] ■ Astrophysics [19Ne(Li, $\alpha$ ),82Se(d,p)..]

- PDR collectivity and GDR decay
- Lifetime, proton transfer(t, $\alpha$ )

# Onset of collectivization/clusterization phenomena in light neutron-rich nuclei



Theoretical approch:  $SM \rightarrow Cluster model \rightarrow Continuum SM$ 

. . . . . . . 10.66 7.2 10.21 7/21 9.98 15 8.59 8.966 Me 7.24 6.90 6.269 5.54 5.08 5.15 Narrow 4.58 4.70 resonances 18 3.944 3.957 Me Г~ 5-60 keV 3.154 3.23  $\Gamma_{.}/\Gamma \sim 10^{-3} \cdot 10^{-6}$ 2.779 2.372 1.4717 1/2" 0.0960 J<sup>#</sup>=5/2 T=3/2 <sup>19</sup>O

S.Leoni





### THIRD INTERNATIONAL SPES WORKSHOP



October 10-12, 2016 Laboratori Nazionali di Legnaro (Padova), Italy

### 47 LoI presented from around the world

#### LOIs 2016 TOPICS





# Shell evolution

# Collective modes

# SPES RIBs

Shell Evolution (GALILEO/AGATA, GRIT/TRACE, NEDA, cryo target): Valiente\_1 (d,p),(t,4He): around 78Ni (82Ge,84Se,81Ga,80Zn) Valiente\_2 (d,n)(3He,n): 10C, 17F, 20Na, 22Mg, 24Al, 26Si Assie\_3 (3He,n): 7Be, 15O, 26Si (proton decay of the excited states) Mengoni\_4: around 132Sn Dominguez\_4.1: around 132Sn with ATPC Pain\_5 (d,p)(d,t),(d,3He)(p,t): structure on the Ge,Ga etc Gottardo\_6 (d,p)(t,p): transfer on top of isomers in 83Se,81Ge,80Zn Recchia\_7 (d,4He)(p,3He): 70Cu(d, 4He)68Ni or 70Cu(p, 3He)68Ni, 68Co(d,4He)66Fe or 68Co(p,3He)66Fe. Iskra\_8: (95Sr,7Li) 96,97Y Leoni\_9: 7Li(95Rb,4He)98Sr

Astro (GALILEO/AGATA, GRIT/TRACE, cryo target): Trippella\_11 (d,p): s-process 85Kr, 79Se, 135Cs Pain, Mengoni(d,p): r-process, in the Ge and Sn region

K.Chipps  $\rightarrow$  JENSA Lol (envisages a transfer campaign)

### ... more than 10 Lols

+ COULEX Lols



FLUKA& MCNPX calculations experimentally validated @ ORNL

#### pure 132Sn : 10E7 pps

# Around 132Sn





### PDR in EXOTIC NUCLEI @ SPES Inverse kinematics inelastic scattering

- Evolution of PYGMY Structure along isotopic chains: Sr, Sn, Te,
- RIB beam 10-20 MeV/A
- Liquid H, He and solid <sup>13</sup>C targets, active target



#### AGATA/GALILEO

- Si Telescopes (TRACE)
- Scintillators (LaBr<sub>3</sub>/PARIS)

### **SPES LOI:**

Low-lying dipole excitations via nuclear probes in exotic nuclei





# **Conclusion and perspectives**

- Two phases for science in near future at LNL: stable and RI beams.
- Detection-setup assortment considered in both phases, including highly segmented Si dets.
- Enormous possibilities for GRIT with RIBs and other to be considered with stable beams.