

Professional CV of Simone Dell'Agnello

Highlights:

- Staff Level II Researcher (Primo Ricercatore) at INFN-LNF (≥ 1995)
- Coordinator of Technology Research/**CSN5** at INFN-LNF (2011-15)
- Worked in Particle Physics, INFN-**CSN1** (1987-2003)
- Leader of: 1 Space Science/INFN-**CSN2**, 3 R&D/INFN-**CSN5** Experiments (2004-2014)
- Leader of INFN Contracts with **Space Agencies** and Italian **Ministries** (2004-2014)
 - Contracts: $>4.2\text{M€}$ for Space Flagships: Galileo, Copernicus, COSMO-SkyMed
- Leader of **INFN-NASA Partnership** on Solar System Exploration and Research (≥ 2014)

Education, Early Research Activity in Particle Physics (1987-94)

Born on 15-05-64 in Livorno, Italy. He got his Master (Laurea) in particle physics in '89 at Univ. of Pisa, Italy (110/110; title: *Two-jet Production at CDF*). He was employed by FNAL (US Department of Energy lab) to work on the general-purpose experiment **CDF** (Collider Detector at Fermilab), as Summer/Master Student and Guest Scientist ('87-91) under A. Tollestrup.

In '93 he got his PhD in Pisa, working mostly at Fermilab (with F. Bedeschi) on the discovery of the top-quark elementary particle (title: *Top-quark Search with Secondary Vertexing Tags in W +multijet events in p - \bar{p} collisions at $\sqrt{s}=1.8$ TeV*, INFN PI/AE 94/10). Advisor of Master and PhD thesis was G. Bellettini. His thesis was incorporated and quoted in the top-quark discovery paper (PRD 50, 2966 (1994)). For his thesis he received a Prize of the Italian Physics Society (SIF, '95). In '94-95 held an INFN Postdoc fellowship.

He worked on the Silicon Vertex Detector construction, data taking as *ACquisition Expert* (6 months consecutive online shifts), Quantum Chromo-Dynamics and top discovery analysis.

Research Activity in Particle Physics (1995-2003)

Since '95 he is staff researcher at INFN-LNF (Laboratori Nazionali di Frascati), hired with a national selection led by P. Franzini, to work on the precision experiment **KLOE** (K LOnG Experiment). He worked on many aspects of KLOE: global construction, assembly and magnetic survey (with S. Bertolucci), creating a dedicated optical & laser-based system of precision positioning metrology; drift chamber construction; monitoring/reconstruction of DAΦNE-KLOE interaction region monitoring; run/shift coordination; tracking analysis.

In '00-02 he restarted on **CDF-2** as Leader for re-commissioning of central hadron calorimeters built by INFN in the '80s and was LNF Representative in the Executive Board. After completing his CDF2 duties, he concentrated on running KLOE and optimizing its performance and data yield as Deputy Technical Manager in '03.

Research Activity in Space Physics and Technology (≥ 2004)

He became "Primo Ricercatore" @LNF in '04. He started from scratch a new INFN research activity in space physics and technology: **precision positioning metrology based on laser retroreflectors for Satellite/Lunar Laser Ranging (SLR/LLR)**.

Applications: General Relativity, Galileo/GPS, Earth Observation (EO, including Copernicus & COSMO-SkyMed). He formed and leads a new research group (~ 20 FTE) which developed (J. Adv. Sp. Res. 47, 822–842 (2011)):

- **SCF_Lab** (Satellite/lunar/gnss laser ranging/altimetry and Cube/microsatellites Characterization Facilities Laboratory): a unique space test lab with 2 Optical Ground Support Equipment (**OGSE**) facilities in a new ISO 7 Clean Room
- **SCF-Test**: Industrial procedures for integrated thermal-optical-vacuum characterization of Laser Retroreflector Arrays in accurately simulated space conditions.
- Capabilities for thermal, optical, orbital and structural sw analysis and simulation.
- Full thermal and vacuum characterization for **Cube/Micro-satellites**.

SCF Lab work program for Galileo (and other Space Flagship GNSS):

- **ETRUSCO** ('06-09, Extra Terrestrial laser Ranging to Unified Satellite Constellations): CSN5 R&D to characterize laser reflectors of Galileo (for Satellite Navigation), LAGEOS (for Space Geodesy) and optimize laser ranging to Galileo and GPS-3
 - International, inter-agency, effort of: INFN, Italian Air Force, ILRS (International Laser Ranging Service), NASA-GSFC (inventor of SLR) and Univ. of Maryland (UMD, inventor of LLR)
- **ETRUSCO-2** ('10-14, ASI-INFN Contract, ~2.5M€): industry-level R&D for Galileo/GPS. Flight reflectors of GPS, GLONASS, GIOVE, Galileo have been SCF-Tested
 - Built a Retroreflector Array being proposed for Galileo V2 and, soon, for a patent
- **ETRUSCO-IRNSS** ('13-14, ISRO-INFN Contract) for Indian navigation constellation
- **Laser Ranging to Galileo** ('15-16, MIUR-ASI-INFN "Premiale" Project ~1M€).

Membership of International Working Groups (WGs):

- ILRS: Core Properties and Performance Requirements for laser retroreflectors (\geq '05)
- Internat. Lunar Network (ILN, of 9 Space Agencies): Core Lunar Instruments ('08-10).

ASI Studies and NASA R&Ds ('07-13):

- 2 ASI studies on precision test of General Relativity, lunar science/exploration
- 4 R&Ds with NASA: GSFC (LAGEOS, hollow reflectors); JPL (deep space laser-ranged mass to test $1/r^2$); 2 AO Calls by NASA-LSSO (Lunar Sortie Scientific Opportunities) and by NLSI, **NASA Lunar Science Institute** (lunar retroreflectors).

As NLSI broadened to **SSERVI** (Solar System Exploration Research Virtual Institute, <http://sservi.nasa.gov>), he established an **INFN Partnership with NASA-SSERVI** based on the research program SPRINGLETS: Solar system Payloads of laser Retroreflectors of INfn for General reLativity, Exploration and planeTary Science. This includes DAΦNE-Light and BTF.

MoonLIGHT-ILN (CSN5, '10-12), **MoonLIGHT-2** (CSN2, '13-18) are an advanced lunar research program (Moon Laser Instrumentation for General relativity High accuracy Tests) of **INFN** and **NASA-SSERVI** led by SCF_Lab and UMD.

- Collaborators: in US, UMD, Center for Astrophysics and APOLLO laser station; in Italy ASI-MLRO laser station and INFN/Univ.-Padova.
- Work program: hw construction/test and physics analysis (including Apollo/Lunokhod) for precision tests of General Relativity in the Sun-Earth-Moon system: weak and strong equivalence principle; Parametrized Post-Newtonian constant beta; variation of the gravitational constant ($G\dot{G}/G$); $1/r^2$ (Yukawa) violations; geodetic precession; General Relativity extensions with spacetime torsion and Non-Minimally Coupled gravity.
- Mission opportunities: Luna-27 by Russia ('19), Google Lunar X Prize ('15/16), Chang'E 4/5/6 by China (\geq '15), SELENE-2 by Japan ($>$ '17), NASA AO ($>$ '18).

SCF Lab work program for Earth Observation Flagships: Copernicus and COSMO-SkyMed

- **ETRUSCO-GMES** ('13-16, Global Monitoring for Environment and Security), an INFN-CSN5 R&D experiment for Copernicus, Galileo and COSMO-SkyMed
- **AUGUSTUS** ('14-15), a **MAE-INFN** High-Relevance Project for Copernicus and USA
- **G-CALIMES** ('13-16, ~1.2M€, Galileo-COSMO-SkyMed Absolute Laser Intercalibration with Measurements on Earth and in Space) a **Ministry of Defense-INFN** Contract for the 2012 "Piano Nazionale della Ricerca Militare" (PNRM-2012).
- Delivered and accepted hw, to be proposed for patents:
 - **INCA-G** ("INtercalibratore e Calibratore Assoluto")– Galileo/GPS), an innovative laser-based ground positioning metrology device for COSMO-SkyMed 1, 2
 - **CORA**, COSMO-SkyMed Retroreflector Array, proposed for COSMO-SkyMed 2.

He leads an Italian team of ~20 FTEs (Full Time Equivalents) of INFN employees/associates: physicists, engineers, mathematicians, technicians, students, postdocs (LNF, Rome & Padova).

Publications: >250 papers, >7800 citations, H-index (ISI)>50 (since 1987). He passed the MIUR selection “Abilitazione Scientifica Nazionale” as Full Professor (“I Fascia”, Sector 02/A1, Experimental Particle Physics) for the period 23/01/2014-23/01/2018.

Languages: speaks/writes fluent English and has good French skills.

Roles / Duties with: INFN and Funding Agencies

- LNF Duties: Secretary of Int. Scientific Committee ('04), LNF Activity Reports ('02-03)
- LNF WGs: Scientific Computing, LNF Future, “Alta Formazione & Fondi Esterni”
- LNF Responsible for public works on the upgrade and extension of the main Clean Room Complex of >300 m², ISO 5 to 7 ('11)
- LNF Coordinator of CSN5 Technology Research Activities ('11 – present).
- LNF SCF_Lab: Founder and Leader ('04-present)

- PI of ETRUSCO / CSN5 ('06-09)
- Co-PI of MoonLIGHT-Manned ('07-09), R&D of **NASA-LSSO** (Lunar Sortie Scientific Opportunities); Contract NASA NNX07AV62G; PI: D. Currie of UMD
- LNF Responsible of LARES/CSN2 ('04-08) and, for **ASI**, of industrial optical acceptance test of 110 flight reflectors of LARES in air & isothermal conditions. No SCF-Test done at LNF
- Co-I for **ASI** Study on “Observation of the Universe from the Moon” ('07); Contract ASI I/032/06/040, WP 1500 on LLR (PIs: P. Battiston of INFN and R. Mandolesi of INAF)
- Co-I for **ASI** Study on Cosmology and Fundamental Physics ('07-10); Contract ASI n. I/016/07/0, WP 5200 on “Deep space gravity test”; PI: P. de Bernardis of Univ. of Rome
- Co-I of **ASI** Phase A Study for lunar orbiter MAGIA ('08); Contract INAF-RHI n. 20080508-1, WP on “MoonLIGHT precursor and improved test of gravitational redshift with retroreflectors and atomic clock”; PI: Dr. A. Coradini of **INAF**; Prime: **Rheinmetall**.
- PI/PM of R&D ETRUSCO-2; ~2.5M€ Contract ASI-INFN n. I/077/09/0 (2010-14)
- PI of SCF-Test of laser retroreflectors of Galileo In-Orbit Validation satellites (IOV). Contract ESA-Galileo-INFN n. 4000108617/13/NL/PA ('13-14)
- PI of INFN-CSN5 R&D, MoonLIGHT-ILN ('10-12), and of INFN-CSN2 science program MoonLIGHT-2 ('13-18), evolution/continuation of NASA-LSSO. Co-I of **NASA-NLSI** project
- PI of ETRUSCO-IRNSS, Contract ISRO-INFN n. LEAO 2011 000 261 0101FE (2013-14) for SCF-Test of retroreflectors of the Indian Regional Navigation Satellite System (IRNSS).
- PI/PM of R&D G-CALIMES; ~1.2M€ Contract Defense-INFN n. 10263 27/12/2012 ('13-16)
- PI of AUGUSTUS, Italy-USA study of INFN-Italian **Ministry of Foreign Affairs**, for satellite laser retroreflectors and ground segment geo-referencing devices for EO. Contract MAE-INFN n. PGR 02350 ('14-15). Partners: NASA-GSFC, USGS, NOAA-NIC, ASI-MLRO, ILRS
- PM of “Laser Ranging to Galileo”, a ~1.M€ 'Premiale' project of the Italian Ministry of Research (MIUR)-ASI-INFN; PI: G. Bianco of ASI.

Organization of Workshops:

- 2005, Co-Chairman: **INFN-Space/2**, national workshop on all INFN space activities, LNF Frascati, <http://www.lnf.infn.it/conference/2005/spazio/>;
- 2006, Co-Chairman: **Fundamental physics in space with small payloads**, international workshop, LNF Frascati; <http://www.lnf.infn.it/conference/fps06/>
- 2007, Member of SOC: **Observation of the Universe from the Moon**, national workshop of ASI, INFN, INAF; LNF Frascati; <http://www.lnf.infn.it/conference/moon07/>
- 2012, Chairman: **International Technical Laser Ranging & ETRUSCO-2 Workshop**; <http://www.lnf.infn.it/conference/laser2012/>
- 2013, Co-Chairman: **INFN-Space/3**, national workshop on all INFN space activities; LNF Frascati; <http://agenda.infn.it/conferenceDisplay.py?confId=6535>
- 2014, Member of SOC: **Frontier objects in astrophysics & particle physics**, international workshop, Vulcano, Italy; <http://www.lnf.infn.it/conference/vulcano2014/>.

Selected publications

- CDF Silicon Vertex Detector and top-quark discovery:
 - *The Silicon Vertex Detector of the Collider Detector at Fermilab*, D. Amidei et al., Nucl. Instr. and Meth. In Phys. Res. A350, 73-130 (1994).
 - *Evidence for Top Quark Production in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8$ TeV*, The CDF Collaboration, Phys. Rev. D 50, 2966 (1994).
 - *Measurement of the top quark mass with the Collider Detector at Fermilab*, The CDF Collaboration, Phys. Rev. D 63, 032003 (2001).
 - *Measurement of the W boson mass with Collider Detector at Fermilab*, The CDF Collaboration, Phys. Rev. D 64, 052001 (2001).
- Particle physics and detectors, optical/laser survey/alignment; KLOE papers:
 - *Survey and Alignment of the KLOE Experiment at DAΦNE*, A. Ceccarelli, S. Dell'Agnello, A. Di Virgilio, S. Moccia, in "5th International Workshop on Accelerator Alignment", Argonne National Accelerator Laboratory, IL, USA (1997). LNF-97/045 (P).
 - *The tracking detector of the KLOE experiment*, M. Adinolfi et al., NIM A488, 51 (2002).
 - *The hadronic cross section measurement at KLOE*, The KLOE Collaboration, Nucl. Phys. B (Proc. Suppl.) 144 (2005) 231–237.
 - *Measurements of the absolute branching ratios for the dominant K_L decays, the K_L lifetime, and V_{us} with the KLOE detector*, The KLOE Collaboration, Phys. Lett. B 632 (2006) 43–50
 - *First observation of quantum interference in the process $\Phi \rightarrow K_S K_L \rightarrow \pi^+ \pi^- \pi^+ \pi^-$: A test of quantum mechanics and CPT symmetry*, The KLOE Collaboration, Phys. Lett. B 642 (2006) 315–321.
- Papers on laser-ranging experimental tests of General Relativity and its extensions
 - *Probing Gravity in NEO with High-accuracy Laser-ranged Test Masses*, A. Bosco et al., Int. Jou. Mod. Phys. D, Vol. 16, No. 12° (2007) 2271-2285.
 - *Constraining spacetime torsion with LAGEOS*, R. March, G. Bellettini, R. Tauraso, S. Dell'Agnello, Gen. Relativ. Gravit. (2011) 43:3099–3126.
 - *Constraining spacetime torsion with the Moon and Mercury*, R. March, G. Bellettini, R. Tauraso, S. Dell'Agnello, R. Phys. Rev D 83, 104008 (2011).
- Papers on SCF Lab applications to Galileo and LAGEOS (ETRUSCO program):
 - *Creation of the new industry-standard space test of laser retroreflectors for the GNSS and LAGEOS*, S. Dell'Agnello et al., J. Adv. Space Res. 47 (2011) 822–842.
 - *A unique infrastructure to develop and SCF-Test laser retroreflector arrays for GNSS, EGNOS-V2 and inter-gnss-satellite laser links*, S. Dell'Agnello et al., in "4th International Galileo Science Colloquium", 4-6 Dec 2013, Prague.
- Papers on Lunar Laser Ranging test of General Relativity (MoonLIGHT program):
 - *Fundamental Physics and Absolute Positioning Metrology with the MAGIA Lunar Orbiter*, S. Dell'Agnello et al, Exp. Astron. (2011) 32:19–35.
 - *MoonLIGHT: A USA–Italy lunar laser ranging retroreflector array for the 21st century*, M. Martini, S. Dell'Agnello, et al., Planetary and Space Science 74 (2012) 276–282.
 - *A Lunar Laser Ranging Retroreflector Array for the 21st Century*, D. Currie, S. Dell'Agnello, G. Delle Monache, Acta Astron. 68 (2011) 667–680. Also: D. Currie, S. Dell'Agnello, G. Delle Monache, B. Behr, J. Williams, Nucl. Phys. B (Proc Suppl) 243–244 (2013) 218–228.
- Chapter in Book on Fundamental Gravity:
 - *Probing gravity with next generation lunar laser ranging*, M. Martini and S. Dell'Agnello (in press 2014). In: V. Gorini, U. Moschella and R. Peron. Villa Olmo SIGRAV School 2009 "Gravity: where do we stand?", Springer – Canopus.