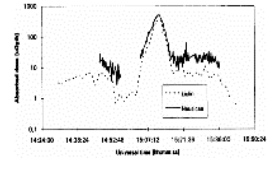
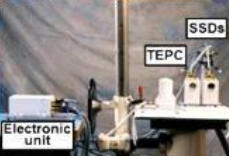
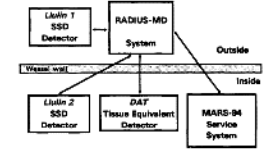
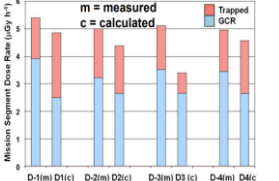
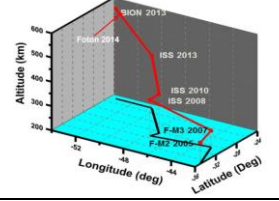
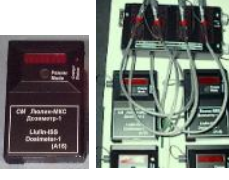
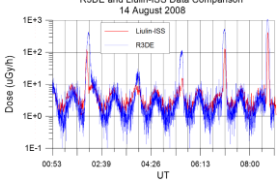
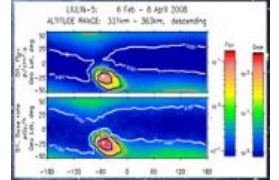
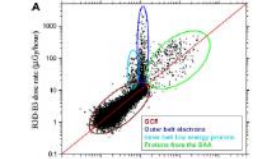
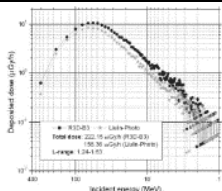
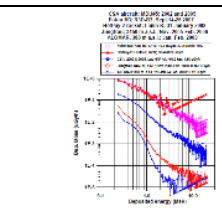
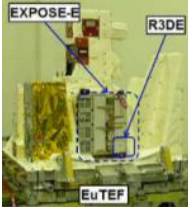
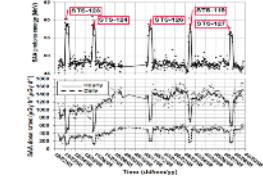
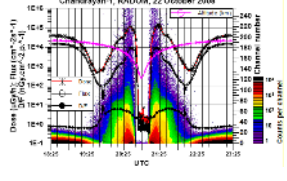
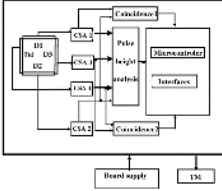
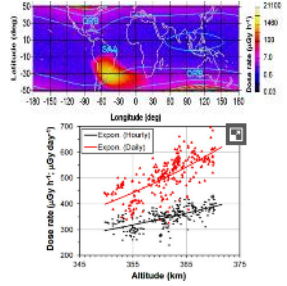
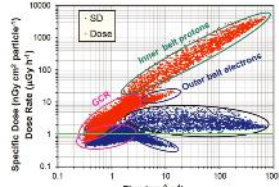
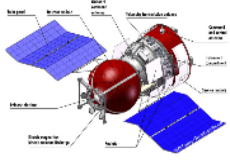
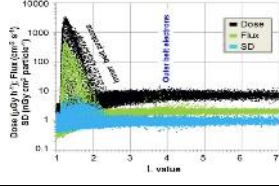
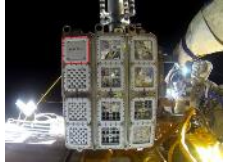
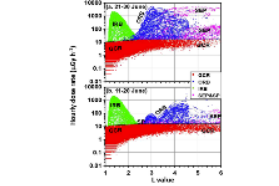
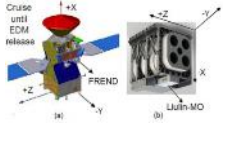
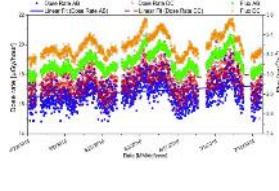
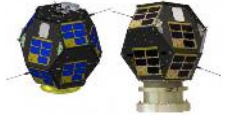
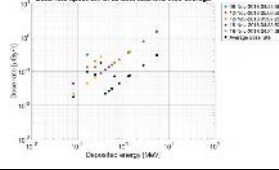
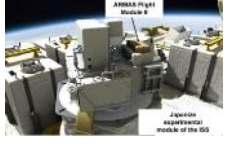
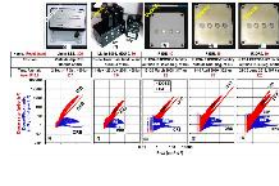
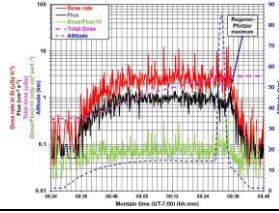
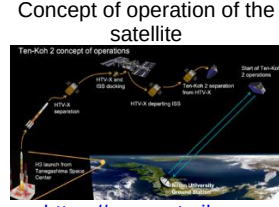


Table 1. Liulin Type Instruments Used In Space Missions

No	Carrier name, Name of Liulin device, Scientific cooperation, (Main Reference)	Data time cover		External view of the carrier (satellite)	External view of Liulin instrument	Example of the scientific results
		Begin (dd/mm/yy),	End (dd/mm/yy))			
1	LIULIN Inside "MIR" Space Station, Bulgaria, Russia (Dachev et al., 1989)	16/04/1989	30/12/1994			
2	RADIUS MD Outside/inside Mars 96 station, Bulgaria, France, Russia (Semkova et al., 1994)	Unsuccessful launch on 16.11.1996				
3	Liulin-E094 with 4 Mobile Dosimetry Units (MDUs) Inside of the American laboratory module of the International Space Station (ISS) Bulgaria, Germany (Reitz et al. 2005) (Dachev et al., 2005, 2006, 2009a)	11/05/2001 (Wilson et al., 2007, Nealy et al, 2007, Slaba et al., 2011)	25/07/2001			
4	R3D-B2 Outside of the Foton-M2 satellite, Bulgaria, Germany (Header et al., 2009)	01/06/2005	11/06/2005			
5	Liulin-ISS 4 MDU Inside of the Russian segment of the ISS, 4 MDU with displays, Bulgaria, Russia (Dachev et al., 2009ab)	01/09/2005	Still operable at the ISS			
6	Liulun-5-Dosimetry Telescope , Russian segment of the ISS, Bulgaria, Russia. (Semkova et al. 2007, 2014)	17/05/2007	09/2015			
7	R3D-B3 Outside of the Foton-M3 satellite, Bulgaria, Germany, Italy, (Header et al. 2009)	14/09/2007	26/09/2007			

8	Liulin-Photo Inside of the Foton-M3 satellite, Bulgaria, Italy, (Damasso et al., 2009)	14/09/2007	26/09/2007			
9	Liulin-S With 4 MDUs, Inside of the ROSCOSMOS, Project Space Suit (Скафандр) at the ISS. (Kartashov et al., 2010)					No information for the performance of the experiment on the ISS.
10	Liulin-R Outside of the HotPay2 rocket, Bulgaria, Norway (Tomov et al., 2008) (Dachev et al., 2012a)	31/01/2008 370 km Apogee at 14.04°E, 70.67°N,				
11	R3DE Outside of the ISS, on ESA Columbus Module and inside of ESA EXPOSE-E facility, Bulgaria, Germany (Dachev et al., 2012b)	22/02/2008	22/06/2009			
12	RADOM Outside of the Chandrayaan-1 satellite, Moon circular orbit at 100/200 km. Bulgaria, India (Dachev et al., 2011)	29/10/2008	07/11/2008			
13	Liulin-Phobos Outside of the Phobos-Grunt interplanetary station, Bulgaria, Russia, (Semkova et al., 1994)	Unsuccessful entry in interplanetary orbit on 8/11/2011				
14	R3DR Outside of the ISS "Zvezda" Module and inside the ESA EXPOSE-R facility, Bulgaria, Germany, (Dachev et al. 2015a)	20/02/2010	20/08/2010	 		

15	RD3-B3 Inside of the BION-M No 1 satellite, Bulgaria, Germany, Russia, (Dachev et al. 2015b)	19/04/2013	13/05/2013			
16	RD3-B3 Inside of the Foton-M No 4 satellite, Bulgaria, Germany, Russia, (Damaso et al. 2016)	18/07/2014	31/08/2014		 The RD3-B3 instrument was used for second flight on Foton-M No 4 satellite	
17	R3DR2 Outside of the ISS "Zvezda" Module and inside of ESA EXPOSE-R2 facility, Bulgaria, Germany, (Dachev et al. 2017)	25/10/2014 <i>In the Liulin database, this is the most advanced set.</i>	10/01/2016		 The R3DR instrument was used for second flight on ISS	
18	Liulin-MO Outside of the ExoMars Trace Gas Orbiter (TGO), Bulgaria, Russia, (Semkova et al., 2018, 2024)	22/04/2016, (Semkova et al., 2018)	(Still operable in Mars 400 km orbit)			
19	Liulin Ten-Koh Inside of the Ten-Koh satellite, Bulgaria, USA, Japan (Fajardo et al., 2019)	29/10/2018	16/01/2019			
20	Liulin-SET Outside of the Japanize experimental platform of the ISS Bulgaria, USA. (Tobiska et al. 2024)	17/03/2022	09/12/2022			
21	Liulin-CNR-VG Inside of VG Spaceship Two Unity, Bulgaria, Italy (Dachev et al., 2024)	for about 8 hours on 29 June 2023				
22	Liulin Ten-Koh-2 Inside of the Ten-Koh-2 satellite. Bulgaria, USA, Japan	Operated since 11/3/2026				Concept of operation of the satellite  https://aero.cst.nihon-u.ac.jp/okuyama/ten-koh-2/

The data received from the following instruments LIULIN, Liulin-E094, R3D/B2/B3, R3D/E/R/R2, Liulin-5, RD3-B3 and Liulin-MO are part of the “Unified web-based database with Liulin-type instruments”, which is available online, free of charge at the following URL: <http://esa-pro.space.bas.bg/database>. The instrument data are stored together with the orbital parameters. The following link, contain the user manual of the database: <http://esa-pro.space.bas.bg/manual>

More information for the published papers and their citations for almost all developed in SRTI-BAS Liulin type instruments is available at: http://scholar.google.com/citations?user=uzmW_mwAAAAJ

For more details about Liulin instruments, feel free to contact Prof. Tsvetan Dachev, SRTI-BAS, Acad. G. Bonchev Str. Block 1, 1113 Sofia, Bulgaria, Mobile: +359 878 366 225; E-mail: tdachev59@gmail.com

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