Merging galaxy clusters: probing magnetism and particle acceleration over cosmic time

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LIST OF PUBLICATIONS

First author

1. **Di Gennaro**, van Weeren, Cassano, Brunetti, Brüggen, Hoeft, Osinga, Botteon, Cuciti, de Gasperin, Röttgering, Tasse. *A LOFAR-uGMRT spectral index study of distant radio halos*, to be submitted, A&A.

2. **Di Gennaro**, van Weeren, Rudnick, Hoeft, Brüggen, Ryu, Röttgering, Forman, Stroe, Shimwell, Kraft, Jones, Hoang. *Downstream depolarization in the Sausage relic: a 1–4 GHz Very Large Array study*, 2021, ApJ, 911, 3.

3. **Di Gennaro**, van Weeren, Brunetti, Cassano, Brüggen, Hoeft, Shimwell, Röttgering, Bonafede, Botteon, Cuciti, Dallacasa, de Gasperin, Domínguez-Fernández, Ensslin, Gastaldello, Mandal, Rossetti, Simionescu. *Fast magnetic field amplification in distant galaxy clusters*, 2021, Nat. Astron., 5, 268.

4. **Di Gennaro**, van Weeren, Andrade-Santos, Akamatsu, Randall, Forman, Kraft, Brunetti, Dawson, Golovich, Jones. *Evidence for a merger induced shock wave in ZwCl 0008.8+5215 with Chandra and Suzaku*, 2019, ApJ, 873, 64

5. **Di Gennaro**, Venturi, Dallacasa, Giacintucci, Merluzzi, Busarello, Mercurio, Bardelli, Gastaldello, Grado, Haines, Limatola, Rossetti. *Cosmic dance in the Shapley Concentration Core. I. A study of the radio emission of the BCGs and tailed radio galaxies*, 2018, A&A, 620, 25

6. **Di Gennaro**, van Weeren, Hoeft, Kang, Ryu, Rudnick, Forman, Röttgering, Brğgen, Dawson, Golovich, Hoang, Intema, Jones, Kraft, Shimwell, Stroe. *Deep Very Large Array observations of the merging cluster CIZA J2242.8+5301: continuum and spectral imaging*, 2018, ApJ, 865, 24

Contributed author

1. Hoang, Zhang, Stuardi, Shimwell, Bonafede, Brüggen, Brunetti, Botteon, Cassano, de Gasperin, **Di Gennaro**, Intema, Rajpurohit, Röttgering, Simionescu, van Weeren, *A 3.5 Mpc-long radio relic in the galaxy cluster ClG 0217+70*, A&A, in press.

2. Botteon, Cassano, van Weeren, Shimwell, Bonafede, Brğgen, Brunetti, Cuciti, Dallacasa, de Gasperin, **Di Gennaro**, Gastaldello, Hoang, Rossetti, Röttgering, *Discovery of a radio halo (and relic) in a* $M_{500} < 2 \times 10^{14}$ $M_{\odot}$ *cluster*, ApJL, in press.

3. van Weeren, Shimwell, Botteon, Brunetti, Brüggen, Boxelaar, Cassano, **Di Gennaro**, Andrade-Santos, Bonnassieux, Bonafede, Cuciti, Dallacasa, de Gasperin, Gastaldello, Hardcastle, Hoeft, Kraft, Mandal, Rossetti, Röttgering, Tasse, Wilber, *LOFAR observations of galaxy clusters in HETDEX - Extraction and self-calibration of individual LOFAR targets*, A&A, in press.

4. Bruno, Rajpurohit, Brunetti, Gastaldello, Botteon, Ignesti, Bonafede, Dallacasa, Cassano, van Weeren, Cuciti, **Di Gennaro**, Shimwell, Brüggen. *The LOFAR and JVLA view of the distant steep spectrum radio halo in MACS J1149.5+2223*, A&A, in press.

5. Osinga, van Weeren, Boxelaar, Brunetti, Botteon, Brüggen, Shimwell, Bonafede, Best, Bonato, Cassano, Gastaldello, **Di Gennaro**, Hardcastle, Mandal, Rossetti, Röttgering, Sabater. *Diffuse Radio Emission from Galaxy Clusters in the LOFAR Two-metre Sky Survey Deep Fields*, 2021, A&A, 648A, 11

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7. Urdampilleta, Simionescu, Kaastra, Zhang, **Di Gennaro**, Mernier, de Plaa, Brunetti. *X-ray study of Abell 3365 with XMM-Newton*, 2021, A&A, 646, A95

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14. Andrade-Santos, van Weeren, **Di Gennaro**, Wittman, Ryu, Vir Lal, Placco, Fogarty, Jee, Stroe, Sobral, Forman, Jones, Kraft, Murray, Brüggen, Kang, Santucci, Golovich, Dawson. *Chandra observations of the spectacular A3411-12 merger event*, 2019, ApJ, 887, 31

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CURRICULUM VITAE

I was born on 16 July 1992 in Mugnano di Napoli, nearby Naples, in Italy. Since I was young I was fascinated by the starry sky, despite the large amount of light pollution in the metropolitan area of Naples. However, I never dreamt about being a scientist. I enjoyed writing, short stories and football articles, and for a period I thought to become a journalist. I started to get engaged with maths thanks to a book, *The Number Devil: A Mathematical Adventure*, which explained mathematical problems through tricks and games.

During the last year of my high school with scientific subjects, I realised that I wanted to study pure science, and to pursue a path of studies in Astronomy. I therefore moved to Bologna, one of the two cities in Italy with a Bachelor program in Astronomy, where I enrolled at the ALMA Mater Studiorum University of Bologna. I received my Bachelor degree on 18 July 2013, and the Master degree in Astrophysics and Cosmology on 18 March 2016. During these years, I gained interests in radio astronomy and the physics of the largest structures in the Universe. I started my research experience by studying the properties of the radio galaxy population in several galaxy clusters located in a supercluster, the Shapley Concentration, using GMRT observations, under the supervision of Prof. Dr. Daniele Dallacasa and Dr. Tiziana Venturi. This work led to a publication, and it was presented with a poster at the "Galaxy Environment and Evolution 4" and "Active Galactic Nuclei 12: a Multi-Messenger perspective" conferences. After my graduation, I was selected to participate at the Leiden/ESA Astrophysics Program for Summer Students (LEAPS), where I worked on low-frequencies (P-band, 230–470 MHz) VLA observations of M87 under the supervision of Dr. Francesco de Gasperin and Dr. Huib

Intema.

I started my PhD in October 2016, where I studied the physics of particle acceleration and magnetic field amplification in merging galaxy clusters, under the supervision of Prof. Dr. Huub Röttgering and Dr. Reinout van Weeren. I spent the first two years of my PhD working at the Center for Astrophysics | Harvard & Smithsonian in Cambridge (MA), USA, as a Pre-Doctoral Fellow. There, I had the chance to work with the major experts in cluster X-ray analysis, such as Dr. William Foreman and Dr. Christine Jones. At the same time, I improved my skills in radio analysis. During these two years, I mostly worked with *Chandra* and VLA data, and I realised the importance of combining among the farthermost wavelengths in the electromagnetic spectrum to get new insights in cluster astrophysics. At the end of the two years, I was invited to present my work at the internal High Energy Seminar. I moved to Leiden in October 2018, where I started to work also with LOFAR data. My work on diffuse radio emission in clusters at high redshift, published in *Nature Astronomy*, was shared with the non-astronomical community through several press releases, and got a great impact in online scientific blogs and magazines. For this project, I was also interviewed by the Italian podcast *Co.scienza*. Since 2019, I have been participating with the outreach website "She speaks science" (`http://www.shespeaksscience.com`) to translate science-related stories and experiences from female scientists from English to Italian. The aim of this outreach association is to increase the science engagement by inspiring young people into STEM, and to make STEM inclusive by promoting women and minority scientists. During 2019, I also co-supervised the project of a Master student at Leiden Observatory, whose results has become part of a peer-reviewed publication. During the four years as PhD candidate at Leiden Observatory, I have led several successful observing proposals, and I have started collaborations with researchers outside my working group, both in the LOFAR and in international collaborations. I shared the results of my work at several conferences and workshops, in Italy, Germany, USA, India, Netherlands, and Vietnam. I have also been invited to present my work at the next European Astronomical Society (EAS) meeting, occurring in June-July 2021.

Starting from September 2021, I will be a von Humboldt Fellow at the Hamburg Observatory, Germany, and a member of the Quantum Universe – Cluster of Excellence. I will continue my work on the physics of particle acceleration and magnetic field amplification in the largest structures in the Universe.

ACKNOWLEDGEMENTS
RINGRAZIAMENTI

Splitting the PhD in two different countries, in two different continents, was not an easy task. Luckily, I had the support of a lot of people who made everything incredibly smooth. Alexandra, Evelijn, Marjan, Monica, and all the other secretaries at the Sterrewacht, thank you for the help and to make everything so easy. I would also like to thank Almin and Donna at the CfA for walking me through the American bureaucracy. A special thanks goes to all the members of the IT, both in Leiden and at the CfA: Frank, Rob, Erik, David, and all those who are behind the 'syshelp' nickname, I am extremely grateful for the infinite patience, quick responses and practical support for any computing issues I had. PhD life would be much harder without all of you.

It takes a village...

I strongly believe that working in a group, and being surrounded by supporting people, is essential to successfully finish your PhD. During these years I have been lucky to find a wonderful village, who supported me both academically and personally.

I would like to thank the amazing people I found at, and because of, the CfA. To all the people in the High Energy group, and especially Bill and Christine, for the always stimulating scientific discussions (also, cakes and coffee at the group meetings were highly appreciated!). Alessandro, Anna, Cecilia, Elena, Fabrizio, Federica, Felipe, Francesca, Gerrit, Lorenzo, Malgosia, Rafael, Raffaele, Sofia, Susanna, Vincenzo, and all the people who

passed by Garden Street, thank you for the wonderful time and chats in the coffee lounge. Felipe, thanks for being such a patient (non-)supervisor. Everything I know about X-ray is because of you (I'm sorry, you must take the blame!). And thank you for all the BBQs and Caipirinhas, you set a bar that will be hard to reach. Alessandro, Lorenzo, Raffaele, Gerrit, thank you for including me in your special group. I somehow miss the Fridays with terrible (mostly) shark-related movies, and graphs on pizza consumption (tho, I'm still upset by the poor choice of the colour palette). Susanna, Federica, Micaela, you have been such amazing friends. The trips, dinners, concerts, will be always in my heart. Vincenzo, thank you for showing me that playing guitar is always a good idea, even in a moving car or in front of the city hall of Palermo, Maine.

To my wonderful American parents, Bill and Shelley. Words will be never enough to express how grateful I am to both of you for welcoming me in your house, and to consider me as your daughter #4. Having a home and a family during my time on the other side of the ocean was incredible important to me. I will always miss you, and the Sunday family dinners. Steve, Maria, thank you for everything you have done for me. Zena (and Alex), you have been such an amazing flatmate. I am so glad we have met, and that somehow we are still in touch.

I would like to thank all the members of the LOFAR group/collaboration: Alessandro, Alex, Alexander, Andrea, Annalisa, Anniek, Aurora, Chiara, Christian, Cristina, Daniele, Dennis, Duy, Erik, Fabio, Fra, Franco, Frits, George, Gianfranco, Ian, Joe, Joseph, Josh, Julius, Kamlesh, Kim, Lydia, Marisa, Marcus, Matthias, Mariachiara, Marisa, Martijn, Paola, Rafäel, Roland, Rossella, Sarah, Tim, Virginia, Wendy, Xuechen, Yuhan, and those I might have missed. Science discussions and conferences would have been so boring without you all. Gianfranco, Daniele, Fabio, thank you for mixing science discussion and football teasing. Rossella, thank you for being such a caring scientist and person. Marcus, working with you was fun from the first moment, and I am very glad we will continue to interact even more closely. Virginia, thanks for the continuous encouragement, and to have introduced Bill and Shelley to me. Tiziana, Simona, a great part my love for cluster radio astronomy comes from you. Your appreciation in these years was such a honour for me, and I will always consider myself a member of the Shapley Lovers group.

A huge thank to all my (current and previous) STRW fellows for the great time we had during the borrels, lunches, coffee breaks, BBQs and all the social activities: Aayush, Alessandro, Andrea, Alex, Andrej, Anna, Anniek (thank you so much for the Nederlandse samenvatting), Christos, Dario, Dilovan, Eleonora, Emanuele, Erik, Francisca, Fraser (my fake-mean buddy who always provided me food at the borrels), Frits, Gaby, Hiddo (my least favourite Dutch person :P), Igone, Josh, Jit, Kim, Kirsty (I will never be thankful enough for introducing me to the basketball team), Lammim (thank you so much for taking care of my plants when I was

not around!), Mantas, Maria Cristina, Marta, Martijn, Martijn, Matteo, Matus, Omar, Pooneh, Rafäel, Roland, Santiago, Stijn, Tommaso, Valeriya. Igone, Joe, MJ, Matteo, thanks for being such nice officemates. Jit, I am so glad you are one of the first person I ever met in Leiden, and that we could walk together through the tough path that is called PhD. I learned a lot from you. Ale, we shared the office during our Master project in Bologna and I am so happy we could repeat the experience in Leiden for few months. Discussing and sharing bad-quality news was such a nice distraction during the infinite LOFAR and VLA processing. Christos (and Andrea), Ele, Jit, MariCri, Tom, Vince, even before I officially moved in Leiden you have been so welcoming, and such great friends. Thank you all for the dinners, laughs, chats and tough words. Dilovan, it's incredible how quickly we clicked, I couldn't have found a better person to have fun with. Thank you for all the time spent together, the walks, the biking to the tulip fields and to the beach. Drinking wine, and all the conversations that came with that, with you and Omar is one of the funniest memories I will carry with me.

I strongly believe that (watching and playing) sport makes you forget about all the issues you may have. To "my" Inter, a huge metaphor of life: going through (several) failures and disappointments before reaching (few) moments of joy and satisfaction: thank you for constantly forging my strength, for being crazy and never boring. I am extremely thankful to everyone at the LUSV for the games, training, pub crawling and borrels we had. To all the girls in the Ladies 3 and 1 teams: Ana, Annalise, Arthur, Carmen, Debbie, Emily, Faye, Floor, Ib, Jorike, Kim, Kirsty, Louise, Lotti, Marjan, Myrenka, Ratima, Rosanne, Sabine, Salma, Satu, Sifra, Yaël, Wypkie. Playing basketball and hanging out with you was so fun. To my (almost entirely) Dutch family, Aydin, Debbie, Giac, Jessie, Leon, Luuk, Marco, Marlon, Sandy. Thank you for keeping me mentally sane during the lockdown, and reminding me that age is just a number (unless you are older than 27, then apparently all the troubles start). I have so many gezellinge *memories of you*. Jess, having you around made me extremely lucky, and proves that opposites attract. Thank you for your emotional support, the continuous encouragement, the silly moments and serious conversations, and the late drinking nights: everything was incredibly important to me. I am extremely happy to be your Gabber.

Nella lista di persone che meritano menzioni speciali non possono mancare quelle che mi hanno accompagnato dai primi giorni in cui ho deciso di iniziare il percorso in Astrofisica: Ali, Circos, Euge, Franci, Sara, dirvi grazie è quanto di più banale, ma estremamente vero, ci possa essere. Per tutte le conversazioni stupide per alleggerire i momenti difficili, per il supporto costante che mi date, per le verità scomode (e talvolta moralizzatrici) e per i confronti scientifici... grazie, grazie, grazie. Avervi nella mia vita è un bellissimo privilegio, e so di poter contare su di voi in qualunque angolo di mondo ci possiamo trovare (anche se Bologna resterà sempre il nostro

punto di riferimento). Bob, Luca e Peppe, grazie anche a voi per essere parte di questa famiglia. Raffi, grazie perchè mantenere un'amicizia per quindici anni, dieci dei quali a distanza, non è semplice, ma è sempre bello sapere che comunque ci proviamo.

Alla mia famiglia, nessuno escluso: essere fisicamente lontana da voi è sempre la cosa più difficile. Adina, cocca mia: grazie per la tantissima forza che mi trasmetti quando ci parliamo. Ai miei genitori, che ogni giorno spero di rendere orgogliosi: grazie per essermi sempre vicino, e per avermi insegnato a non accontentarmi mai. Vinz, grazie per avermi sopportata in casa, che fosse Milano o Mumbai. Irene, grazie per aver reso il (primo) periodo delle application meno stressante solo con la tua presenza, e perdonami se ho adorato vedere la tua faccia della tristezza. Infine, ma non per ultimo, un grazie speciale a Giulia, la persona cui questa tesi è dedicata. Se dovessi mai diventare la metà di quello che sei, potrei solo ritenermi fortunata.

Aan iedereen: dank je wel[1].

[1]Thanks Jess for double checking this, as my Dutch skills stop at: *Ik heb een glas wijn nodig.*

Dicette o pappice vicino a' noce, ramm' o tiemp' ca te spertose.

The warm said to the nut, give me time and I'll break you.