## Acknowledgements

"Dunque io ringrazio tutti quanti.
Specie la mia mamma
che mi ha fatto cosí funky."

"So, I thank everyone.

Especially my mom

who made me so funky."

– Articolo 31, Tanqi Funky, 1996 –

I jumped the pond a little less than 5 years ago because I had a taste of what being a physicists in the US might be like and wanted more. I came to this vast and sometimes inhospitable land thinking I'd learn a lot of physics (which I did) and hoping I'd keep doing research for as long as I could (which I'm fortunate enough to say I'll still do for a while). Little did I know that getting my PhD would be first and foremost a journey to self discovery, the beginning of a path to asymptotically tend to the person and the scientist I want to be. A journey impossible without the help of many people, which I will now proceed to thank. Let's hope that the acknowledgements won't be longer than the thesis itself.

Mom, you are and will always be the hero of my story; I know this has been challenging for you, thanks for being there for me at every hour of the day and the night, for being always honest and for somehow handling this whole US-Italy thing gracefully. I can't believe you still haven't met Bonnie. Ah, and don't worry, I'll always translate things for you.

Bonnie Fleming, my advisor, I don't even know where to start in thanking you. Thanks for listening to me before I proved I was worth be listened to; thanks for always believing I could make it, even at the bottom of my doubts; thanks for all the laughters, for all the freedom, for all the great advices; thanks for leading by example; thanks for being always supportive of all my crazy side projects; thanks for choosing each and every person in the most wonderful research group ever and thanks for letting me be part of it. Thanks for showing me that even Bonnie Fleming is human, has her downs and still she thrives.

Flavio Cavanna, my co-advisor, working with you has been one of the greatest pleasures of my academic life; the extent of your knowledge never ceases to amaze me and the freshness of your enthusiasm is always contagious. Thanks for all the time spent in your office banging our heads on these cross section analyses and thanks for convincing me to join LArIAT in the first place.

Ornella Palamara, after a particularly heated exchange at a wine and cheese, I once told Andrzej I think of you as my spirit animal: fierce, knowledgeable and direct; he replied I still need to walk many miles to get there and I can't agree more.

A big thank you to my academic sisters, from the youngest to the oldest (again academically speaking): Supraja Balasubramanian, you worked the magic of enriching my past, thank you from the bottom of my heart; Brooke Morrison, the depth of your knowledge, your drive and love for our field has been a constant inspiration; Ariana Hackenburg, thanks for keeping me sane for the last four years, if you run for president – as you should – remember to delete our Skype chats, love and hugs to you dudette; and last but not least Xiao Luo, Fermilab has given me lots of extraordinary gifts, but no one bigger than your friendship.

Jen Raaf and Jonathan Asaadi, these analyses would have not seen the light of day without you. Thanks for your many inputs and for letting your door open to talk about physics and/or my latest paranoia. Thanks for the patience and understanding. And thanks for leading that small experiment with a big heart called LArIAT and all its crazy ponies. Speaking of which, thanks to all my collaborators, especially Irene

Nutini, who started the path for the pion analysis, Greg Pulliam, who suffered with me at the end of said path, Dan the Man, Jason, Johnny, Will Fo and Mr Bojangles. A special token of gratitude goes to Roberto Acciarri and Andrzej M. Szelc, you are so much more to me than collaborators and previous car owners, you know you'll always have a home in Chicago (or wherever this job will bring me).

Thanks to the MicroBooNE experiment which has been an incredible learning experience. I want to thank Sam Zeller for the countless pieces of advice, Jessica Esquivel, whose passion and resilience I deeply admire, my CRT troopers Martin, David, Rui, Igor and Linda – if I know something about hardware it's because of you – and Kazu and Kirby, who I shamelessly bothered many times for software help, sushi and coffee.

To all the members of the NPG, thanks for all the laughters and all the wise insights. You're the smartest bunch of idiots I've ever met, I love y'all.

Shany Danieli, Louise Laage and Flor Orosz Hunziker, you're the piece of heart I left in New Haven. Shany, I don't know what made you think I was the cool kid in the group, but I'm so glad you stuck with me. I'm not sure I would have survived my first semester at Yale without you. Your intelligence is matched only by your kindness: you have the rare gift to shine and make others shine with you. Louise, my dear, thanks for always finding the time to listen, for your attuned spirit and for the magnolias. Flor, thanks for welcoming me to the new world with love and providing me with the correct definition of "America".

Thanks to all the people which helped me make Chicago and Fermilab my new home, in particular David Caratelli, Mateus Carneiro, Pilar Coloma, Ciaran Hughes, Gordan Krnjaic, Seyda Ipek, Kiel Howe, Adi Ashkenazi and Rob Fine.

To the wonderful people who stayed close even with an ocean in between: la Tasso, Marci, la Bea, la Kittirn, Alvin, la Viola e Brogna, Sighi, la Secchi and the people from the "La Chiappia Nuova" group, thanks for making me feel like I never left.

Finally, thanks to Anto, my husband, my topo and my adventure companion, cause people might think I'm nice and easy, but you know I'm not... And still, you followed me across half the world and you're here, so that I can never feel alone.