Radiative transfer models of protoplanetary disks: Theory vs. observations
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It’s done! Before you lies the book that will be the heritage of four years of hard labor. It is the product of thousands of hours of brain power and computing time, of eureka moments and disappointments, and of collaboration and solitude. As the casual reader may have noticed, most of this thesis is written in the first person plural. This is not a case of pluralis majestatis, but merely testimony to the fact that modern-day astronomy is inevitably a team sport. As such, I am indebted to a lot of people for their support during the production of this thesis.

Above all I would like to thank Carsten, my promotor and scientific mentor of these past years. Being a good supervisor is one of the duties that are not always taken seriously by staff members with a busy agenda, but you have always taken the time to help me when I got stuck, to extensively discuss the projects we worked on, and to push me when it was needed. I’ve always felt like I could bring any idea or question into your office, and that has been a great comfort. You’ve been an excellent supervisor and I’ve learned a lot from you. Although it’s time for me to fly off into the world, I hope we will continue to collaborate in the future, wherever I may come to work.

Much, if not all, of the work of this thesis is based on the numerical code written by my co-promotor. Michiel, you wrote an awesome code that I’ve been able to use, abuse and exploit over the past years. I would like to thank you for all the improvements you made and your amazing bug fix speed, and the time you took to teach me how to use and modify it. I may have complained about MCMMax every now and then as well (ahum, comments, ahum) but the truth is that having you around – or close by in Utrecht for a while – has been one of the reasons why this book has become thicker than I had originally expected. Thanks a lot and keep it going!

There are many collaborators, in and outside of Amsterdam, that I am very grate-
Acknowledgements

ful to. Rens, thanks for your never-ending enthusiasm, and for dragging me into the HD 100546 project, that in the end grew out to be a major part of this thesis. Kees, although we haven’t worked together that much, you have a very inspiring personality and seeing your clean coding style was a revelation. Olja, thanks for taking the lead in and reanimating the MIDI project, I’m sure our fruitful collaboration will continue now you’re in Cambridge. Roy and Bram, your introductions into the complex world of interferometry were very enlightening. Sijme-Jan, your help with getting the hydrodynamics started has been invaluable, and I hope we will embark on new projects in the near future. Til, thanks for your assistance with the grain size distributions and hosting my visit to Heidelberg. Koen, discussing with you about MCMax and Herbig stars has been very interesting, and I’m looking forward to reading your thesis one day as well. Inga, thanks for your extensive comments on this manuscript.

I would also like to thank the many people that shared their data that a thesis like this partly relies on: John for sharing his Hubble data and making Chapter 5 possible; Arjan for helping me out with the VISIR data and getting Chapter 3 published. Christian for our efforts to understand LkCa 15 with ADI (I’m sure we’ll figure it out soon!); And of course the DIGIT collaboration: Neal for leading the group; Jeroen, Bernhard, Johan and Thomas for the many discussions on dust mineralogy (“but where’s the iron?”); Joel for showing us around in Austin (check the bookmark!); Gwen for sharing her experience on Herbig Ae/Be stars when I was new to the field.

Many people at the institute have indirectly contributed to this thesis, in particular the “low-energy group” that has provided a stimulating scientific environment to do this research in. I’ve enjoyed the discussions in our group meetings, and certainly learned a lot from you. Thanks to all ‘cookies’, new and old: Mihkel, Rik, Lucas, Saskia, Sebas, Gerrit, Lianne, Joop, Lex, and many more. I would also like to thank Karen Hellebout for the awesome presentation skills course that she gave. I don’t think I’ve ever learned so much in only a few days, and still use those skills today. Alex, thanks for organising that course, and for your efforts with the inquisition and the noise troubles.

The API has a great social atmosphere, and I’m very happy that I’ve been a part of it for the past years. Thinking of all the party’s, breaks, trips and excursions; the windmill, the elephant, de oerknal, de polder... it has been a great time. Thanks to all API’s, and especially my long time office mates and friends: Montse for being cheerful, teaching us how to play mus, for the rum and the fruit (so healthy!), and for teaching me those Spanish words that are absolutely essential... to describe where I live; Theo, I don’t know how you managed to miss that flight, but as long you keep those pineapples coming I won’t complain; Yuri, for being the most modest Italian that I know, and the only person I would know that would go on a Belgian beer tour.
without drinking a single drop of alcohol$^2$. We made some memorable trips the four of us: Belgium, Paris, Barcelona... And 2013 means... Brazil?

A special mention has to go to Maithili, for consistently mispronouncing my name in the strangest possible ways. I could not have wished for a better preparation for my US trips. Probably the first attempt, which sounded like ‘jigs’, is the closest you’ll ever get. At least there is no ‘k’ or ‘r’ in it, which seems to turn up in most attempts. Keep trying! Martin, thanks for all the beers we shared, for all the meaningless and meaningful conversations, and for consistently being yourself. It is greatly appreciated! Caroline, I appreciate your friendship and the many conversations we had, and will never forget your hilarious German accent when speaking Dutch. No thanks for the fish though, and to think that I shaved off my beard for you!

Thanks to all other API’s who have been around the past years, and for many memorable moments: Oscar, for our joint efforts during the Cosmology course we taught (I can’t believe you did it twice!) and for travelling with us to Paris... or did you? Samia (Fromage!), your wedding with Delphine was the coolest one I’ve ever attended; Peter, for the never-ending board games. Olga, thanks for the hilarious potted beard$^3$, it’s the only one I have left now... All whiskybreak (or should I say whiskeybreak?) members: John & Daniela, Mike & Sera, Yvette & Barack, Ken (the picture tradition has disappeared, but the break lives on!) and others; Phil, Antonia and the rest of the first British invasion on Dutch soil since William the fifth. And of course, all the other people that I’ve shared an office with over the years – you’re truly lucky you’ve never been able to hear the music that comes out of my headphones ;).

Writing this I realize how much the institute has grown, and how many people have already left the place, while some have stuck around. Thanks to all the old-timers that have been around longer than their PhDs: Konstantinos, Thijs, Evert and Alexander, and to those of you who have left already: Nathalie, Daan, Maciej, Hendrik, and Eduardo. Burcu, thanks for spending more than a year with me, I’m sorry it didn’t work out in the end. And last of the institute, but certainly not least: thanks to the secretaries for supporting us and being part of the group: Lide, Minou, Milena (sorry for poisoning you), Eva and Esther back in the day, and Nathalie and Marieke that just arrived.

Buiten het instituut om zijn er ook nog een aantal mensen die ik wil bedanken, voor hun steun en vriendschap. Allereerst Ton en Andrea: bedankt voor jullie onvoorwaardelijke hulp, ook al ben ik niet altijd even goed in contact houden. Wouter, leuk dat jij mijn paranimf wou zijn, en voor het ver-engelsen van de introductie (*Oxford commas* en *non-restrictive clauses*, je leert elke dag wat bij). Sarah, bedankt voor

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$^2$ We’ll just ignore that vast amounts of evidence demonstrating the contrary that have turned up on your defense party.

$^3$ See also first footnote.
alle keren dat ik in Nijmegen heb mogen crashen na concerten. Je gaat een nieuwe fase in je leven tegemoet (30-plus!), geniet ervan. En natuurlijk mijn familie, in het bijzonder mijn tantes Marie-Anne en Rosemarie, voor alle kaartjes, de gezelligheid op de familiereünie, en jullie interesse in mij en wat ik in het dagelijks leven zoal doe als sterrenkundige. De Nederlandse samenvatting vanaf pagina 173 is tevens een toegankelijk opstapje naar mijn onderzoek.

Ook wil ik langs deze weg mijn goede vrienden bedanken: Remco, we zijn al meer dan de helft van ons leven bevriend en ik hoop dat we dat ook blijven als ik naar het buitenland verkas. Ik zal het samen eten koken zeker missen, maar de talloze concerten en festivals (13 keer lowlands!) gaan we zeker mee door. Martijn, bedankt dat jij er voor me was tijdens een moeilijke periode aan het begin van mijn PhD. Helaas heb ik het afgelopen jaar weinig tijd gehad om naar Rotterdam te komen, maar ik ben het niet vergeten! Ook wil ik nog mijn andere festival- en concertbuddy’s bedanken, voor talloze onvergetelijke en oorverdovende momenten: Bas, Jordy en Koen; Arnout, Ossy en Ronny.

Getting towards the end now, I would like to thank the creators, actors and comedians of The Big Bang Theory and Mock the Week for their near-weekly dose of absolute hilarity that made me relax after a hard day’s work. Many thanks also to George R. R. Martin, for creating the epic and immersive tale of A Song of Ice and Fire. And last of all, but certainly not least, I want to thank all the bands that make the music that I love. Even though few people like it and most people regard it as pure noise terror, it remains my other big passion besides astronomy. So keep playing, touring and recording!

As tradition dictates, dawn is breaking while the deadline is approaching, and this thesis is ready to be printed.

Gijs Mulders
Amsterdam, January 2013
Embrace me
For one last time take me there
Something’s out there
And it won’t lead me astray

– Soilwork, Spectrum of Infinity