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*A history of missing mass, 1930-1974*

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*how*  
DARK  
MATTER  
*came to*  
MATTER  
*A History of Missing Mass, 1930-1974*

JACO DE SWART

## HOW DARK MATTER CAME TO MATTER



How Dark Matter Came to Matter  
A History of Missing Mass, 1930-1974

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor  
aan de Universiteit van Amsterdam  
op gezag van de Rector Magnificus  
prof. dr. ir. Karen Maex

ten overstaan van een door het College voor Promoties ingestelde commissie,  
in het openbaar te verdedigen in de Aula der Universiteit  
op vrijdag 4 februari 2022, te 11.00 uur

door Jacobus Gerardus de Swart  
geboren te Groesbeek

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Whereas the role of science is to reveal what we do not see,  
the role of philosophy is to let us see what we see.

– Michel Foucault 1994: 3.540-541

A process cannot be understood by stopping it. Understanding  
must move with the flow of the process, must join it and flow  
with it.

– The First Law of Mentat (Frank Herbert 1984: 34)



# ACKNOWLEDGEMENTS

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This thesis is about things in the cosmos that we cannot see. But it is not only the cosmos that goes largely unseen. Much of what constitutes one's existence is often hidden from view, and so too are many things that helped constitute this thesis. Friends, family, colleagues, neighbours and others have supported, inspired and helped me in the writing of this manuscript over the past five years. They have my immense gratitude and deserve to be visible.

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J.G. DE SWART

*Amsterdam*  
*January 2022*



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